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THE QUARTERLY BULLETIN
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A BRIEF HISTORY OF THE DISCOVERY OF CITRUS CANKER IN JAPAN AND EXPERIMENTS IN ITS CONTROL

By
DR. TYZABURO TANAKA, Translator
U. S. Dept. of Agriculture

Citrus scab, otherwise known as verrucosis or Orange-leaf scab, is one of the commonest diseases of the mandarin and tangerine in Japan. When applied to orange fruits it is called "Kasa" and it is widely mentioned by the Chinese name, Sôkabyô. Affected fruits are even designated in early citrus literature as though a special type of mandarin, as "Kasa Mikan". An illustration in the manuscript work "Nankai Hôfu" (Orange of South Sea Districts, written by Yamanaka Shinko, revised by Uemachi Kunihiko, preface 1865. 2 v. in 3 books. Colored plates), (which has a profound reputation as the early standard work on Japanese Citrus), shows the fruit of Satsuma orange affected by scab, nicely drawn, together with healthy fruits of Nyûkitsu or Unshû Mikan (Satsuma). It is doubtless true, however, that Japanese citrus growers had paid little attention to the scab disease of mandarins before a similar disease of Navel orange was found in Kyûshû Island in 1899 or about that date.

This disease of Navel orange in question was not found anywhere before the cultivation of this orange commenced in the commercial area devoted to citrus fruit in Japan. According to a statement of Toshichika Tamura(1) the Navel orange was first introduced into Japan from California in 1890 by Prof. Tamari, the present director and professor of the Kagoshima Imperial Agricultural and Silvicultural College, but the imported plants failed to grow where planted. In 1891 an important introduction was made by Sanjirô Senda, who was sent to the United States from one of the citrus trading companies of Naka-gun, Wakayama-ken, bringing home two healthy plants which were secured in California through the assistance of Yonoshin Dômoto. One of the stock plants was successfully grown by Sen'emon Horiuchi of the same province, who made a considerable propagation from it, plants of which have been distributed all over the citrus growing prefectures of the Empire.

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(1)Tamura, T., Nippon Engei Zasshi (Journ. Hort. Soc. Japan), No. 131, pp. 3-9, Apr. 1908.

The earliest discovery of a pest on this variety identical with what is now known as "Citrus Canker" was reported as "a kind of pathogenic microbe" by Mr. Kumanoshuke Abe, in his elaborate work "Nippon no Mikan" (Citrus in Japan), published in May, 1904, pp. 162-165. Mr. Abe was the first to engage in orange growing in Kyûshû (Southern) Island. He acquired a thorough knowledge of the industry by travels throughout the orange growing regions for more than twenty years and his standing as a member representative of the Imperial Parliament and as a founder of the most active organization of the agricultural community of Fukuoka-ken, lends special weight to his excellent work on citrus culture. This work takes authoritative rank and is the only publication of this nature which has been honored by the Meiji Emperor becoming one of its readers.

Mr. Abe's description is quite definite and there can be no doubt that he first found the infection on Navel oranges in Tanushimaru, a nursery district of the Fukuoka prefecture, in 1899 on the stocks from Wakayama-ken, possibly brought from those propagated by Mr. Horiuchi in Naka-gun. He defined this infection as a new disease caused by an unknown organism and the opinion was accented by Prof. Tamuri, who was known at that time as one of the most enthusiastic supporters of the Navel orange industry of the Island.

To quote briefly: "The first symptoms that appear are on the under surface of the leaves and are small rusty colored spots a little elevated from the surface. This spot is easily transmitted to the other foliage developed in the same year; also attacks the shoots, causing destruction of this part of the tree. * * *

"In the nursery of Tamushimaru there are many plantations of Satsuma trees which, in many cases, surround the Navel nurseries; no infections were discovered on the Satsuma, even where Navels were attacked rather severely by the disease. Other varieties like Natsu-daidai, Yamabuki-Mikan, and the trifoliate orange, all of them considered to have similar habits to the Navel orange, were found to be slightly affected by the disease, and the susceptibility of the navel orange is also considered due to the softness of the twigs, leaves and bark. * * *

"The severity of the organism is more pronounced in the wet years and spreads more rapidly at such times. As to methods of prevention and extermination, it has not been sufficiently experimented with as yet; but it would be wise to take the precaution to burn up all diseased leaves and twigs, which should be cut off and collected immediately upon the discovery of the affection. The application of Bordeaux mixture once in the springtime and once more in the winter season is recommended for the prevention of the disease."

The infection was found very severe everywhere in the northern part of Kyûshû Island during this period and the incessant questions sent in by the growers caused considerable alarm among the officials of the sub-station of the Imperial Agricultural Experiment Station located at Kumamoto, not far from the place where the disease was raging. This fact is fully illustrated by the statement of Umenojô Bokura(2), assistant pathologist of the central station, quoting a letter received from the sub-station dated January 9, 1903, the translation of which follows:

"In connection with the swift development of the Navel orange cultivation in Kyûshû Island, a kind of disease, as is seen from the specimen enclosed, is gradually spreading over the cultivated area, which seems to be prevalent on sweet oranges, not showing marked effect on Japanese mandarins, leading us to consider it as one of the most undesirable of diseases and of dangerous nature. It seems to attack young plants mostly and young orange stocks of one or two years old are often found dying from the infection. The affection also can be found on grown trees, usually on branches and on fruits. The fruits make a poor appearance spoiling their value as market fruits. * * * "

As an official of this sub-station, Dr. Tôji Nishida, now the inspector and chief of the Kôbe sub-station of the Imperial Plant Quarantine Station, published an article in the Journal of the Agricultural Society of Japan under the title "Kankitsu no Sôkabyô" (Citrus Scab)[1] giving a similar description of the disease as reported by a local grower in conversation.

In this article Nishida did not attempt to describe the disease to any extent, hastily comparing this with and identifying it as the same disease which was first described in the United States as Citrus Scab, caused by *Cladosporium Citri*, figured in articles by Lamson-Scribner, G. Massee, and Messrs. Swingle and Webber. His determination was chiefly made from the description and illustrations by Lamson-Scribner (Rept. Comm. Agr., 1886, issued 1887, pp. 120-121, pl. 4), according to a later statement by him,[1] but whatever be the opinion about the cause of the disease, this article bearing the date February 1903, seems to rank as the first Japanese publication relating to Citrus Canker, preceding by more than one year the publication by Mr. Abe.[1]

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(2) Bokura, Umenojô, Kankitsunae to Kwaiyôbyô (Inspection of Citrus stock with special attention to Citrus Canker), Byôchû-gai Zasshi (Journ. Plant Protection) 4, No. 11:838-843, Nov. 1917 (Japanese).

[1] Nishida, Tôji. In Dainippon Nôkwaihô (Journ. Agr. Soc. Japan), No. 258:1-4, Feb., 1903.

According to Bokura, there has been a number of similar communications from localities other than Kyûshû Island. The Kogoshima-ken Agricultural Society reported the occurrence of the disease in the prefecture about the year 1902 and in Shidzuoka-ken, Shinsaku Kano and Kisaku Oda of the village Asahata-mura, Abe-gun, reported as early as 1899 or 1900 the occurrence of a similar trouble on plants brought from Wakayama-ken propagated by Mr. Horiuchi. We have no evidence of the occurrence of this disease in the original planting in Wakayama-ken or in the prefecture at this time, it being stated by Mr. Abe that he found no disease there at the time he discovered it in Kyûshû Island.

In Naka-gun the prevalence of the disease was called to the attention of the prefectural officials, as shown in the following letter from the Ken Nôkwai (Prefectural Agricultural Society) to the Imperial Central Experiment Station, dated Oct. 31, 1904. This is also published by Mr. Bokura in the same article. The translation is as follows:

"In Arakawa-mura, Naka-gun, of our prefecture, there started a new disease of Washington Navel orange which seems to be rather serious to the growers of the Navel oranges and we are very anxious to take prompt steps to exterminate this disease as far as possible. We desire to have the immediate consideration of your officials on this matter and trust to have proper suggestions in regard to the nature and the possible method of control for the disease. We are enclosing a statement of the present condition of the disease in the prefecture and sending a few specimens of the infected fruits and leaves by parcel post.

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[1] ——— ———, Sókabyô to Kwaiyôbyô (Citrus Scab and Canker), Kwaju (Fruit Tree), No. 152:29-32. Illus. Nov., 1915. See Phytopathology.

[1] No mention is made in Mr. Abe's work as to why his publication was delayed until the middle of 1904. As Viscount Kanô mentions it in his preface dated February 8, 1901, it must have been completed prior to that time. It could not have been later than January, 1903, when the book was ready for publication, according to the date in the author's preface, so his statement as to the pest on Navel oranges undoubtedly antedates Nishida's publication. Mr. Abe does not give any description of Citrus Scab but emphasizes the distinct nature of the new disease in very clear statements unlike later articles which thoroughly confuse it with the common scab of mandarin and lemon.

1. The locality of the infection found.—Arakawa-mura. Wakayama-ken and the vicinity.
1. The acreage of the infection.—About 12 Chô (30 acres).
1. Infected plants.—Navel orange, Satsuma, and Trifoliate orange.
1. Age of plant affected.—Young stocks as well as grown plants 7 or 8 years old. No apparent difference between the young and grown trees.
1. General remarks on the disease.—Most severe in Washington Navel orange, also found on Satsuma and trifoliata to some extent. The infection occurs mostly on young plants, particularly infecting the fruits, not only attacking the leaves and twigs. The young leaves fall off as soon as the infection starts, and the fruits never show full maturity even at the time of ripening. Those fruits cannot be kept in the storehouse as decay starts immediately from the infected spots.
1. The extent of the damage.—20 to 30 fruits out of 50 from one tree were found infected in the severest case, some trees have only 5, 6 or 10 out of 50 in cases less affected.
1. The occurrence in previous years.—According to some ambiguous statements it was found two years before last, but it would be more correct to say that it was found in the year before last by a few people of the same place. This is the first year that the disease revealed itself as a dangerous infection.

In concluding this passage Mr. Bokura says: "In consideration of these data derived from all communications and published articles, we may conclude that the first occurrence of this disease in Japanese territory was a few years before 1900, its devastation gradually spreading during 1900 and 1901 with the result of attracting the attention of the local growers."

In the previous article of Mr. Bokura the first discovery in Arita County is given as in 1904, based on a verbal statement of Mr. Den Yabune, a famous citrus grower of the same county. He refers to a report written by Umekichi Hashimoto, Shûsaku Aoki, and Nishigaya, sent as the representatives of Shidzuoka growers to inspect citrus conditions, which was published under the title "Wakayama-ken Kankitsugyô Chôsa Hôkukusho" (Report on the citrus industry of Wakayama-ken) and appeared in 1904. The translation of the passage is made as below:

"Mr. X (it is told that this was Mr. Yabune) said, there is a new disease of Navel orange which has just been discovered this year in the Navel orchard. The symptoms shown by the disease are blackish-brown spots on leaves and the young buds, causing yellowing and withering of the leaves and defoliation as a consequence. Fruit infections follow immediately afterwards, which is characterized by yellowish-brown or reddish-brown spots, slightly depressed at the center of the infection. When such spots appear abundantly it causes the fruit to change to a yellow color and soon afterward such fruits begin to drop from the tree. The nature of the disease seems to be serious in every respect, the cause of which is entirely unknown. * * * ”

Mr. Bokura’s interpretation is that this is an “undoubted case of the infection of Citrus canker as far as the symptoms show, and Mr. Aoki, one of the writers, told me that it was a real canker”.(6)

From Shikoku Island, the disease is also reported by N. Yano(7), who started a close examination after his return from Kyûshû Island following a visit to Mr. Abe’s orchard which he made in 1902. He states that he never found the disease until 1905 when the disease was discovered in a Navel orchard in Kita Uwa-gun of the Ehime prefecture. He also states that the disease must have been introduced to the island about 1902 from Wakayama-ken and Hyôgo-ken prefecture with the Navel stocks. His first report was issued in the “Gyômu Kôtei” (Annual report of the Ehime-ken Agricultural Experiment Station), published in 1904.

In response to many questions from those interested in horticultural industries, Prof. Tetsuya Onda, the Chief of the Imperial Horticultural Experiment Station, Okitsu, Shidzuoka-ken, expressed the opinion that the scab attacking the Navel orange was quite distinct from that which infects the Kunembo (King orange) and Satsuma(8).

His article is written to convince the growers of the satisfactory results of Bordeaux spray for the purpose of preventing Citrus scab of Satsuma orange, summarizing the experimental results which were obtained at his station since 1903, and giving no detailed differences between these diseases. However, he gave his opinion about the definite nature of the disease, which should not be confused with the common scab, in saying: “It is absolutely baseless to consider that the scab of Navel orange exists in all localities where the variety is under cultivation. Not a single plant of Navel orange stock did I find showing any infection of the disease in the prefecture of Kagawa-ken, which I visited lately and carefully inspected the plantings in Kinashi, Hasioka districts of Ayauta-gun and also in other counties. This is rather a surprising fact for the consideration of the believers in the common occurrence of the disease"(9).

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(6) See (3) p. 841.

(7) Yano, N., in Iyo no Engei (Hort. of Iyo province) 2:no.2.p.14-17, Jan., 1915. Full translation by Tanaka, see file.

(8) Onda, Tetsuya, Kankitsu no “Kasa” Byô ni tsukite (On scab disease of Citrus) in Kwaju (Fruit trees) no. 39:20-28, 40:16-19, Jul.-Aug., 1906. (Japanese). See no.40.p.22

In the second article of Dr. Nishida(10), the distinction between the symptoms on these different varieties is clearly given with illustrations. He maintains strongly, however, the identity of the organism which causes these diseases whatever may be different in the symptoms. The most important passages of the article are translated as below:

"There has been reported to me a difference existing in the scab diseases of Navel orange and Natsu Daidai, and of Satsuma. It may be true that the symptoms widely differ * * , but is is not a rare instance that one disease may show a difference in symptoms when appearing on different hosts. I rather incline to say both are caused by the same organism, and can be treated by the same remedies to prevent the occurrence in the orchard. The following is the reason to maintain my hypothesis:

1. The same organism is to be isolated from these different hosts. An inoculation experiment is in progress, and the determination of the species of the organism is also now under investigation.
2. The spots occurring on the parts of the same tree are always the same, the two never mixing on one tree.

In discussing further the history of the Citrus canker in Japan, Dr. Nishida cites(11) the paper of Prof. S. Hori, Pathologist of the Imperial Central Agricultural Experiment Station, in a monthly journal "Nippon Nôgyô Zasshi" (Japanese Agricultural Journal) No. 6 and 7, Feb. and March of 1914, in which is mentioned the scab disease of Navel orange, reporting the isolation of some certain kinds of fungi, *Leptosphaeria*, *Ramularia*, and others. Nishida also mentions that this disease is specialized by the name Marugata Sôkabyô in the explanatory text of the exhibited specimens and charts represented at the Taishô Exhi-

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(0)Onda, Tetsuya. Nevuul Kan ni tsuite (On Navel Orange). In Kwaju (Fruit trees) 45:p.8. Apr., 1907. (Japanese).

(10)Nishida, Tôji. Futatabi Kankitsu no Sôkabyô ni tsukite (Again on the Citrus scab) in Kwaju (Fruit Trees) no. 42:6-10, illus. Oct., 1906.

(11)*See* Nishida (5) p.30.

bition, held in Tôkyô in 1914. The plate according to Nishida published in the Byôchûgai Zasshi (Journ. Plant Protection) 2:no. 1 (Jan. 1915) is one photographed from the exhibited chart which evidently shows the drawings of infected Navel orange with the Satsuma, under the general name Mikan Sôkanyô (Citrus scab) and Nishida also interprets that the picture of the pathogenic organism figured in this chart is the fungus belonging to the genus *Cladosporium.*(12) It was not until November 1914 that the definite name Kankitsu Kwaiôbyô was created to correspond with the American term Citrus Canker, a report on which, written by Stevens (Florida Agr. Exp. Sta., Bull. 122, March, 1914) is reviewed by Dr. Nishida in his work "shinpen Kankitsu Byôgai to Yobôhô (New treatise on Citrus diseases and methods of prevention)", published on Nov. 25, 1914, *(see* pp. 171-184).

This chapter, according to the postscript, was added after the print blocks of the previous part were prepared, and no change in the chapter on "Citrus Scab" is to be found in this work, where the infection of Navel orange is given as caused by the same organism which affects Satsuma orange.

Nishida also states that he received a specimen of infected trifoliate orange from F. A. Wolf of Alabama Polytechnic Institute through Prof. Kusano of the Tôkyô Imperial Agricultural College, but does not mention any observation of the microscopic character of the infecting organism. In addition to this statement he quotes a communication from B. F. Floyd, of the Florida Agricultural Experiment Station, to whom Nishida sent specimens of infected Navel orange fruit and leaves, which brought the reply that it was a real Citrus Canker!

In the meantime, Prof. Hori published a long article in connection with the discovery of Citrus Canker in the United States. He gives a review of the article written by Wolf and Massey (1914, Circ. No. 27 Alabama Exp. Stat.). Preceding the review(13) Prof. Hori's article deals with correspondence with the Alvin Nursery Company, Grand Bay, Alabama, and gives warning to the Japanese citrus exporters and growers to pay immediate attention to diseases of a similar nature occurring on the Japanese Navel oranges. He stated: "At present I doubt

(12) *See* Nishida (5) p. 30.

(13) Hori, Shôtaro Hokubei Mekishikowan Engan Chihô ni oite Nippon-san Kankitsunae Haiseki no Hô ari, aete waga Kankitsu Saibaisha oyobi Yushutsu-gyôsha ni Keikohusu (Warning to the Citrus growers and exporters of Japanese Citrus stocks to the Gulf Coast, on account of the occurrence of a new disease found on the imported plants). In Byôchû-gai Zasshi (Journ. Plant Prot.) 2 no. 1:1-7. Jan., 1915. (Japanese.)

whether the disease in question exists in Japanese territory * *, but as the symptoms of the reported disease so closely resemble those which occur on Navel orange in Japan, which have already been described by the writer as Enkei Sôkabyô (round scab), we should take immediate steps to find out whether they are the same or different. The organism which causes the latter I considered a species belonging to *Cladosporium,* but it has not been as yet decided. The infection of trifoliate orange, which is more common in western part of Japan than in eastern, also shows microscopic similarity with the one reported from the United States. This should also be promptly investigated * * * ".

The next number of Byôchûgai Zasshi(14) gives a provisional translation of Plant Quarantine Act No. 19 of the Federal Horticultural Board of the U. S. Department of Agriculture, issued on Dec. 10, 1914, and, as an editorial note, repeats the warning to the exporters and the growers to pay "full attention to all kinds of diseases, to use sufficient methods of precaution for preventing the spread of infection both for the purpose of self-protection and for the interest of other nations".

In the review of Miss Hasse's paper on the discovery of bacterial origin of the canker(15), Mr. Bokura gives an interesting note about a similar discovery made by the pathological laboratory of the Imperial Agricultural Experiment Station. The full translation of the note is as follows:

"As to the organism causing this disease, previous opinion chiefly centered on *Cladosporium Citri* and *Phoma Aegles* without basing conclusions upon any inoculation experiments. Acting upon the evidence demonstrating the distinct nature of the disease from the ordinary scab as shown in the experimental results of the Alabama Experiment Station, Prof. Hori started to collect material from various parts of Japan. In examining this material in the laboratory, he soon discovered the existence of a certain kind of bacterium in the diseased tissues and consequently he issued an order immediately to Dr. Nishiyama, an employee of the laboratory, to isolate it and to conduct an inoculation experiment in the experimental farm. This was in January 1915. Soon afterward it became known through Mr. Swingle, who happened to be on a visit to Japan at that time, that Miss Hasse had cabled to him telling of her discovery of a bacterium as the cause of the disease. The name of the bacterium as given by her *(Pseudomonas Citri)* was also made known by Mr. Swingle. Entirely independent of this discovery, Prof. Hori's bacteriological experiments are still progressing under the careful investigation of Dr. Uyeda, the bacteriologist of the station."

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(14) Beikoku no Gwaikokusan Kankitsu Yunyû Kinshi (Prohibition of the importation of Citrus from foreign countries into the United States) in Byôchû-gai (Journ. Plant Prot.) 2 no. 2:1-2, Feb., 1915.

(15) Bokura, Umenojô. Kankitsu Enkei Sôkabyôgen ni tsukite (On the cause of the Citrus canker), "H. Hasse, Pseudomonas Citri cause of Citrus canker, Journal of Agricultural Research, Vol. IV No. 1, p. 97, 1915" in Byôchû-gai Zasshi (Journ. Plant Prot.) 2 no 9:46-47, Sept. 1915.

Nishida and Hori also mention the detection of and experiments relating to the pathogenic organism of Citrus Canker(16) by Dr. Uyeda(17) but no report has been issued by Dr. Uyeda as yet.

As to the discovery of Citrus Canker on Satsuma orange, Nishida made a most important report in 1915(18). He found two different kinds of infection on the same Satsuma orange leaf. This was detected in an orchard located in Aki-machi, Kôchi-ken, Shikoku Island, which was sufficient to cause him to withdraw his former opinion that the organisms causing Citrus Scab and Canker were identical.

In reply to a question of the writer, viz., on what variety of Satsuma orange he first found canker, he states in the letter dated January 8, 1918, that the infection of Satsuma is really a question of the severity of the infection of the surrounding orchards in which infected plants of Navel oranges and Natsu Daidai are to be found. He further says: "I do not claim the entirely resistant nature of the Satsuma variety. It is a matter which largely depends upon the environmental condition and the habit of growth of the twigs. Satsuma is usually grown on terraces; that gives the best opportunity to get rid of the infection. Satsuma does not produce as much summer growth as others, which is another reason for escaping from the severe summer infection. This can be proved by the fact that so many infections of Satsuma orange were found during the last year when the surrounding orchards of Navel orange and Natsu Daidai were so badly infected by the disease, in the prefectures of Osaku-fu and Hyôgo-ken".

Before concluding this sketch it would be worth while to refer to the methods of combating Citrus Canker in Japan and the apparently successful results of controlling it, at least to some extent.

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(16) *See* (5) p. 31.

(17) Hori, Shôtarô. Shokubutsu Byôgai Kôwa (Lectures on diseases of plants) vol. 2:288-289, Tôkyô, Seibido, Nov., 1916.

(18) *See* (5) p. 30-31.

In connection with the extermination experiment on Satsuma Scab started in 1903 in application of Bordeaux mixture as previously mentioned, the plan was made in Wakayama-ken Agricultural Experiment Station and in other local stations, to adapt this method to the disease of Navel orange (the so-called "scab" or canker), which plan was started in 1909 in the orchard of Horiuchi, the first successful importer of Navel orange, previously mentioned.

The experiments lasted until 1912, and four reports were issued; the first(20) in 1910, and the last(21) in 1913. The following is the summary of the results as given in the final report:

Percentage of the annual decrease of infected fruits as compared with infection in 1909; each lot consisting of five trees 11 years old at the beginning of the experiment. (The results of spraying for three years—1910, 1911, and 1912—averaged percentages).

I. SPRING SPRAY (22)

Lot	Time of Spraying	"Nito Gosho" Bordeaux	"Sando" Bordeaux	Sugar Bordeaux	Average	Efficiency Grade
1	Immediately after bloom and two weeks later	15	22	28	22	4
2	Shortly before the bloom, immediately after the bloom, and two weeks later	16	25	28	23	3
3	Immediately after bloom, two weeks later, and four weeks later	34	28	22	28	1
4	Shortly before the bloom, immediately after bloom, two weeks later and four weeks later	24	30	23	26	2
	Average of percentages for each spray	23	26	25	—	—
—	Efficiency; grade	3	1	2	—	—

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(20) Wakayama-kenritsu Nôji Shikenjô (Agr. Exp. Stat.), Nôji Shiken Seiseki Hôkoku (Bulletin) No. 2, for the fiscal year 1909, issued Nov. 1910, p. 79-83.

(21) ————, Rinji Hôkoku Kanritsu no. Bu. (Prelim. Rept. on Citrus experiments'. Jul., 1913, p. 47-62, and Nôji Shiken Seiseki (Bulletin n. ser. No. 5, Aug 1913. p 47-62.

(22) The standard Japanese Bordeaux mixtures described in the Imp. Agr. Exp. Sta Abridged Bull. No. 20, pp. 1-10 (issued Jun. 1911) are as follows:

Standard weight of chemicals in ordinary Lime Bordeaux { Copper sulphate 120 momme (approx. 1 lb.),
Stone lime 100-120 momme (0 83-1 lb.)

Water Dilution { "Nito Shiki" : 2.0 To (approx. 9½ gal. (0.83-1 lb)
"Nito Gosho Shiki": 2.5 To approx. 12 gal) 1 "To"=approx. 4¾ gal.
"Sando Shiki" : 3.0 To (approx. 14¼ gal.)

Sugar Bordeaux { Copper sulphate 100 momme (0.83 lb.)
Stone lime 100 momme (0.83 lb.)
Cane sugar 50 momme (0.4 lb.)
Water 2.0-2.5 To (9½-12 gal.)

II. SUMMER SPRAY

Lot	Time of Spraying	"Nito Gosho" Bordeaux	"Sando" Bordeaux	Sugar Bordeaux	Average	Efficiency Grade
5	The time when the summer shoots appear, and two weeks later	32	24	24	27	1
6	The time when the summer shoots appear, two weeks later, and four weeks later	19	30	26	25	2
—	Average	26	27	25	—	—
—	Efficiency: grade	2	1	3	—	—

The percentage of the affected fruits in the control lot is given as follows:

	1909	1910	1911	1912	Average decrease
Lot 7	100	100	99	81	7

The results show that no matter which fungicide is used, the sprayed lots had less infection than the unsprayed. At the beginning of the experiment, nearly all fruits examined were found 100 per cent infected in every lot, but where sprayed the percentage dropped off considerably in the following two years. There was also found, not only a decrease in the number of infected fruit, but a decrease in the severity of infection of individual fruits that is quite remarkable.

As to the time of spray, the application given twice in the summer season is nearly as effective as spraying three times in the spring season; the former method is both a saving of labor and reduces the expense for chemicals. The strength called "Sando Shiki" Bordeaux showed the best result in the long run and is also the cheapest of all the spray dilutions used.

Similar experiments were conducted at the experiment stations of Kôchi-ken, Nagasaki-ken, and Shidzuoka-ken.

The summary of four years' results of the experiment conducted by the Kôchi-ken Agricultural Experiment Station is as follows:

1. Trees used in experiments.—Washington Navel orange, 10 trees in each lot.
2. Object of experiment.—To find out which fungicide is most effective in reducing the severity of the infection of Citrus Canker.

3. Spraying times used in different experiments—
   (1) April 15.
   (2) April 27.
   (3) April 29.
   (4) At the time spring buds coming out.
   (5) May 26.
   (6) At the time when fruit is grown as large as a pea.
   (7) June 2.
   (8) June 23.
   (9) Three times; spring, summer and autumn shoots are coming out.

EXPERIMENTAL RESULT

Kinds of Fungicide	1913 (23)		1914 (24)		1915 (25)		1916 (26)	
	Spraying times	Infected fruits %	Spraying times	Infected fruits %	Spraying times	Infected fruits %	Spraying times	Infected fruits %
Lime Bordeaux "Sando Shiki"	(3)(7)	1.5	(4)(6)	46.0	(4)(6)	75.0	(1) (1)(2) (1)(2)(5)	0 8 0
Lime Bordeaux "Sando Shiki"	(3)	17.2	(6)	43.1	(9)		(1)(2)(3)(4)	0
Lime Bordeaux "Nito Shiki"	(3)(7)	0.5	(4)(6)	72.7	(4)(6)	83.		
Lime Bordeaux "Nito Shiki"	(3)	1.5	(6)	48.1	(6)	79.		
Lime-sulphur mixture Sp. G 0.5 degree	(3)(7)	9.9	(4)(6)	83.3	(4)(6)	96.		
Lime-Sulphur mixture Sp. G 0.5 degree	(3)	19.1	(6)	69.1	(6)	92.		
Lime-sulphur mixture Sp. G. 1.0 degree	(3)(7)	14.2	(4)(6)	69.7	(4)(6)	88.		
Lime-sulphur mixture Sp. G. 1.0 degree	(3)	17.5	(6)	85.3	(6)	87.		
Control (no application)		14.1		80.5		86.		11.

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(23) From the review given in Ryôchû-gai Zasshi (Journ. Plant Prot.) 2,no.4:60, Apr. 1915

(24) Kôchi-Kenritsu Nôji Shikenjô (Agr. Exp. Stat.) Taishô Sannen-do Gyômu Hôkoku (Ann. Rept. for the fiscal year 1914), issued May 1915.

(25) ———, Taishô Yonendo Gyômu Hôkoku (Ann. Rept. for the fiscal year 1915), issued Apr. 1916.

(26) ———, Taishô Gonendo Gyômu Hôkoku (Ann. Rept. for the fiscal year 1916), issued Apr. 1917.

The results show no positive effect of spraying in years when the infection is very severe and is only relative when the infection is slight in comparison with average years.

From the results obtained at the Experiment Station of Shidzuoka-ken during the fiscal year 1911 and 1912, the effect of spraying is summarized as follows:

"The spraying experiment with "Sando Shiki" Bordeaux mixture three times a year (March, June and July) was most successful among the series of experiments where more than 50 per cent of fruit were protected from infection."(27)

"In all cases the sprayed lot showed better results than the control. Among the sprayed lots, three applications (1) middle of April, early in June, late in July, and (2) middle of April, late in July, early in August, show better results than any others, which demonstrates the efficiency of spraying with Lime Bordeaux mixture in preventing the scab disease of Navel orange."(28)

The experimental results obtained at the Nagasaki-ken Agricultural Experiment Station are as follows:

I. (29)SPRAYED WITH "NITÔ GOSHO SHIKI" LIME BORDEAUX

Spraying Times	Infected fruits Severe	Infected fruits Medium	Percent light	No infection percent
1. Preceding the flower, After the flower.	2.9	2.9	64.2	30.0
2. Preceding the flower, Preceding the summer growth,	3.7	6.5	57.9	31.9
3. Preceding the spring growth, After the flower, Preceding the summer growth,	1.4	8.3	31.2	59.1

A circular has very recently been issued by the Department of Agriculture and Commerce(30) of Japan giving a summary of the present knowledge of Citrus Canker both in Japan and in the United States, the history of its occurrence, nature of the disease and possible methods of prevention in the orchard. This circular records its first occurrence in various prefectures not generally given in published articles, which may be briefly summarized as follows:

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(27)Shidzuoka-kenritsu Nôji Shikenjô (Agr. Exp. Stat.), * * * Gyômu Kôtei (Ann. Rept.) for the fiscal year 1911. Issued Nov., 1912. p. 68.

(28)————, do. for the fiscal year 1912. Issued October 1913, p. 119.

(29)Nagasaki-kenritsu Nôji Shikenjô (Agr. Exp. Stat.), Nôji Shiken Seiseki Hôkoku (Bulletin) no. 17. Issued Feb., 1914. p. 162-163.

1900, Shidzuoka prefecture (Village Asahata, Abe County) on Navel.

1902, Nagasaki prefecture, on Navel.

1903, Saga prefecture (Township Ogi) on trifoliate.

1904, Kumamoto prefecture, on Navel.

1906, Oita and Miyazaki prefectures, on trifoliate.

1907, Mie and Aichi prefectures, on Navel.

The following varieties are mentioned as susceptible:

Navel oranges.

Natsu Daidai.

Trifoliate orange.

Pomelos.

Sweet oranges.

Blood oranges.

Varieties slightly infected:

Kunenbo (this is *Citrus nobilis* proper, or King orange).

Yamabuki (a variety with soft pulp and pithy rind of pomelo-like appearance).

Lemons.

Fingered citron *(Citrus Medica* var. *sarcodactylis).*

Varieties strongly resistant, occurring sometimes on leaves but exceptionally on fruits:

Unshû-mikan (Satsuma orange).

Kishû-mikan (Kinokuni mandarin).

Yuzu.

No natural infections ever found, but may be artificially infected, causing a development of minute pustules of about 0.3-0.6 mm. in diameter:

Kinkan-rui (Kumquat group).

According to this publication, the Japanese government has recently resolved to take immediate action along the same lines as the plant quarantine act of the United States government; to conduct an investigation of the actually infected localities and to issue certificates for the export of fruit which is certified by local inspectors both as absolutely canker free and produced in a canker-free district. The government will pay part of the expense needful in carrying out this new program. It is believed that this action will arouse Japanese growers to the necessity of taking the necessary steps to exterminate this pest, or to prevent its further spread.

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(30) Nôshômushô Nômukyoku (Bureau of Agric., Dept. Agr. & Commerce), Kankitsurui Kwaiyôbyô (Citrus canker) issued as circular dated Dec 1917. Reprint in Nippon Engei Zasshi (Journ. Hort. Soc.) 30 no.8:6-14, 1 fig. Mar., 1918. (Japanese)

CABBAGE WORMS

E. W. Berger

Without undertaking to describe the several kinds of worms (caterpillars) that feed on cabbage in the field, the principal remedies for destroying them will be given. While there are at least five caterpillars (worms) that injure cabbage by devouring parts of the leaves, a worm is a "worm" in that respect, and what the grower wishes to know is how to kill it. And who is there that dose not know a "worm" when he sees it! However, cabbage worms may be the caterpillars of either moths or butterflies.

Arsenical poisons are now the standard remedies for cabbage worms. These are best applied as a spray, but may be applied in dust form mixed with one to several parts of hydrated lime or other dust, when the plants are wet. When applied as a spray they adhere best if some soap is mixed with them. Any kind of spray pump, sprinkling can or whisk broom may be used to apply the spray. For applying dust mixtures blowers, made for that purpose, may be used, or the material shaken onto the plants from suitable cloth sacks.

It is not known that anyone was ever poisoned by eating cabbage that had been sprayed or dusted with arsenicals, and thousands of acres of cabbage are now being protected against cabbage worms in that way; but it is best not to apply these poisons when the heads are ready, or nearly ready, to harvest.

The following formulas are recommended:

1. Paris green 1 lb., water 50 gallons, soap 5 or 6 lbs.
2. Lead arsenate 2 lbs. (powdered), water 50 gallons, soap 5 or 6 lbs.
3. Zinc arsenite 2 lbs. (powdered), water 50 gallons, soap 5 or 6 lbs.

The following remedies are also frequently recommended:

Dust plants with air-slaked lime with which a little salt has been thoroly mixed. (Would suggest handful of salt to 2 gallons of lime.) This remedy may be used on cabbage that has headed, prior to selling. (Recommended by W. F. Massey in Progressive Farmer.)

Hot water, at a temperature of 130° F., applied with a sprinkling can, is also recommended against the young worms.

Hand picking the worms is frequently practiced in small patches or home gardens.

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK FOR QUARTER ENDING SEPTEMBER 30, 1918.

The following report on the canker eradication work, conducted in co-operation with the Bureau of Plant Industry, U. S. Department of Agriculture, during the three months ending September 30, has been compiled by Mr. Frank Stirling, General Inspector:

QUARTER ENDING SEPTEMBER 30, 1918.

Citrus grove trees inspected	1,593,836
Citrus nursery trees inspected	13,745,305
Inspectors employed	193
New properties showing infection	0
Total properties showing active infection	0
Grove trees found infected	0
Nursery trees found infected	0
Counties in which active infections were found	0

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,723
Nursery trees found infected since May, 1914	342,254
Number of properties infected to September 30, 1918	479
Properties declared no longer "danger centers"	437
Properties still classed as "infected" September 30, 1918	42

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to September 30, 1918:

1914		1915		1916		1917		1918	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1
		Mar.	444	Mar.	49	Mar.	9	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2
May	108	May	1042	May	338	May	52	May	1
June	160	June	772	June	450	June	45	June	10
July	275	July	651	July	349	July	39	July	0
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0
Oct.	565	Oct.	214	Oct.	451	Oct.	2		
Nov.	773	Nov.	494	Nov.	131	Nov.	1		
Dec.	366	Dec.	256	Dec.	27	Dec.	1		

QUARANTINE DEPARTMENT

REPORT FOR QUARTER ENDING SEPTEMBER 30, 1918

The following reports on the inspections of shipments and importations, all ports and stations, have been compiled by Mr. K. E. Bragdon, Assistant Quarantine Inspector:

PORT AND RAILWAY INSPECTION

SHIPS AND VESSELS INSPECTED:

From foreign ports	424	
From U. S. ports other than Florida	174	
From Florida ports	193	
Total		791

SHIPMENTS INSPECTED:

		Number of parcels
Arriving by water:		
Passed	11815	
Treated and passed	97½	
Returned to shipper	113	
Detained, subject to return by shipper	0	
Contraband destroyed	616½	
		12642
Arriving by land—express, freight, wagons, etc.:		
Passed	1219	
Treated and passed	116	
Returned to shipper	69	
Detained, subject to return by shipper	30	
Contraband destroyed	27	
		1461
Total parcels inspected		14103

PRINCIPAL PESTS AND DISEASES INTERCEPTED

Insect or Disease	Occurring on	From	Number of Parcels infested
Aspidiotus sp.	*Globularia* sp.	Spain	1
Aspidistra scale	Soursop	Cuba	1
Bephrata cubensis	Soursop	Cuba	1
Black scale	*Pittosporum nigri*	California	1
Cerambycid beetle	Citrus	Jamaica	1
Chaetopsis debilis Loew	Beet	Cuba	1
Chaff scale	Citrus	Spain	1
Chaff scale	Citrus	Florida	1
Chaff scale	Palm	Louisiana	1
Dictyospermum scale	Palm	Florida	1
Dipterous lavae	Beet	Cuba	1
Drug store beetle	Unknown seeds	Spain	1
Florida red scale	Citrus	Florida	1
Florida wax-scale	Chrysanthemum	Alabama	1
Glover's scale	Citrus	Spain	1
Greedy scale	Geranium	Florida	1
Hemisphaerical scale	*Pittosporum nigri*	California	1
Hemisphaerical scale	Soursop	Cuba	1
Hippelates pallidus Loew.	Beet	Cuba	1
Lonchaea polita Say	Beet	Cuba	1
Long-tailed mealy-bug	Beet	Cuba	1

Insect or Disease	Occurring on	From	Number of Parcels infested
Long-tailed mealy-bug	Croton	Pennsylvania	1
Mango fruit fly	Guava	Cuba	1
Mining scale	Mammee	Cuba	1
Oleander scale	Fern	Florida	1
Palm scale	Palm	Louisiana	1
Pineapple rot	Pineapple	Cuba	1
Purple mite	Citrus	Cuba	1
Purple scale	Citrus	Cuba	1
Purple scale	Citrus	Florida	2
Purple scale	Citrus	Honduras	1
Red spider	Begonia	Georgia	1
Red spider	Pepper	Georgia	1
Rufous scale	Citrus	Honduras	1
Soft scale	Beet	Cuba	1
Soft scale	Herbaceous plants	New Jersey	1
San Jose scale	Peach	Mississippi	1
San Jose scale	Plum	Mississippi	1
San Jose scale	Rose	Georgia	1
Termites	Sweet potato	Florida	1
Thrips	Chrysanthemum	West Virginia	1
Tyroglyphidae	Cassava	Cuba	1
Whitefly	Salvia	Ohio	1
Withertip	Citrus	Cuba	2

PARCEL POST PLANT INSPECTION

PARCELS INSPECTED:

Passed	62
Treated and passed	4
Returned to sender	0
Detained, subject to return by sender	1
Infested or infected parcels destroyed	0
Total parcels inspected	67

PRINCIPAL PESTS AND DISEASES INTERCEPTED

Insect or disease	Occurring on	From	Number of Parcels infested
Florida red scale	Oleander	Florida	1
Nematode root-knot	Begonia	Florida	1
Palm scale	Palm	Florida	1
Pustule scale	Oleander	Florida	1
Whitefly	Unknown shrub	Wisconsin	1

WILSON T. DONALDSON, JR.

It is with deepest sorrow that news of the death of Wilson T. Donaldson, Jr., was received by the staff of the State Plant Board. This excellent young man is another one of those to give his life in this, our country's time of need.

Mr. Donaldson was born at Owenton, Owen County, Ky., November 12, 1894. After attending the public schools he became a student in Translyvania College at Lexington, where he pursued special studies for two years. Following this he entered the Mississippi Agricultural and Mechanical College, specializing in agricultural work and graduating in 1915.

On May 13, 1916, he was appointed inspector for the State Plant Board of Florida and Agent of the Bureau of Plant Industry, U. S. Department of Agriculture. In this capacity he rendered constant, efficient and faithful service in connection with the eradication of citrus canker in Florida until June, 1917. During the summer of 1917 he left for his home in Mississippi and shortly afterwards entered the School of Military Aeronautics at Austin, Texas. He completed the course with honors and entered upon his work at Kelly Field No. 2 at San Antonio with enthusiasm. He had been doing solo flying for about a month when, on April 17, 1918, while on a cross country flight, he fell with his aeroplane and later died, on April 20th, having been unconscious from the time of the fall until his death. With military honors he was laid to rest on April 24th at Aberdeen, Mississippi.

On Kelly Field Mr. Donaldson was considered by his superior officers as an apt pupil. He lacked but a few days of receiving his commission at the time of his death.

Mr. Donaldson was a young man of high ideals and quickly earned the confidence and esteem of all those privileged to associate with him. In his death the State Plant Board has lost one of its most efficient workers and henceforth his name will be lovingly held in our memories as one who freely placed his all upon the Altar of Liberty.—F. S.

THE ROLL OF HONOR

The following employees of the State Plant Board of Florida are serving in the several branches of the military service as indicated:

Baker, Byrd O.	Quartermaster Corps
Baker, Thos. J.	National Army
Ball, Jos. H.	Aviation Section
Barcus, Geo. D.	Aviation Section
Bass, Clarence A.	U. S. N. R. F.
Bibby, F. F.	Naval Dispensary
Branam, Jas. R.	U. S. N. R. F.
Brown, A. C.	Veterinary Section
Brown, Luther	Naval Hospital Service
Burden, Geo. F.	Limited Service
Butts, John L.	Aviation Section
Bynum, Eli K.	Infantry
Calcote, Wm. H.	National Army
Campbell, M. G.	Quartermasters Dept.
Carothers, A. B.	National Army
Cary, Chas. L.	National Army
Chandler, Luther L.	U. S. N. R. F.
Clark, Virgil I.	U. S. N. R. F.
Dickerson, Wm. E. S.	Infantry
Dickey, Edward K.	Aviation Section
Dickson, Albert M.	Officers Res. Corps
*Donaldson, Wilson T.	Aviation Section
**Dukes, Redding A.	National Army
Fish, Robert E.	Aviation Section
Fletcher, J. M.	Aviation Section
Fogg, Harry W.	Eng. Service Battalion
Ford, Arthur E.	Marine Corps
Goldsby, Jack K.	Ambulance Corps
Green, Clifford	National Army
Grimes, D. W.	Aviation Section
Hansen, Hans W. A.	National Army
Harden, John C.	National Army
Harkins, Donald L.	Balloon Corps
Harn, Sam P.	Navy
Harrison, Cyrus J.	Aviation Section
Henderson, Francis M.	National Army

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*Killed while flying.

**Died in camp.

Holland, Ed. Alton	Ammunition Train
Hood, Richard Van	U. S. Marines
Howell, John F.	Officers Res. Corps
Ingram, Otis D.	National Army
Irwin, Harry M.	Motorcycle Corps
Jackson, Henry C.	Officers Res. Corps
Jackson, Julian	Mechanics Training Camp
Kersey, Walter L.	Limited Service
Little, Floyd L.	Aviation Section
Lovett, James C.	Medical Corps
Maloney, Clarence B.	Royal Flying Corps
McClanahan, Howard S.	U. S. N. R. F.
McCullough, James D.	National Army
Milledge, Stanley	National Army
Miller, Herbert L.	Aviation Section
Moore, Joseph W.	Navy
Moore, Jules B.	National Army
Neal, Cecil G.	Officers Res. Corps
Niedernhoefer, Wm. F.	Aviation Section
Oliphant, Ross G.	Tank Division
Parker, Frank R.	Navy
Roberts, Samuel F.	Naval Hospital
Robinson, Tom	Quartermasters Dept.
Robinson, V. K.	National Army
Scott, Wm. J.	Hospital Corps
***Seeds, Harvey W.	National Army
Sherman, Chas. D.	Ambulance Corps
Smith, Clyde	National Army
Smith, Jos. G.	National Army
Smith, Lawrence O.	National Army
Steil, Fred H.	Aviation Section
Stephens, Charley S.	National Army
Stevenson, Geo. A.	Navy
Swann, Porter R.	National Army
Tedder, Geo. E.	National Army
Thompson, Troy	National Army
Walker, Geo. S.	Aviation Section
Wilson, G. H., Lieut.	National Army
Wood, Harry E.	Navy

***Missing in action.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*............*Editor*

ASSOCIATE EDITORS.

E. W. BERGER............*Entomologist*
F. M. O'BYRNE............*Nursery Inspector*
FRANK STIRLING............*General Inspector*
J. H. MONTGOMERY............*Quarantine Inspector*
H. E. STEVENS............*Consulting Plant Pathologist*

Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

THE CITRUS SEMINAR.—The Ninth Annual Citrus Seminar, held at Gainesville from September 24th to 27th, was an unqualified success. The most progressive growers of the State were in attendance and the interest was sustained throughout.

Though perhaps not generally known, the Seminar idea was conceived by the late J. A. Stevens of DeLand. It will stand an indestructible monument to this broad-minded man who was passing from our midst during the closing hours of this year's meeting. Though gone, he is not forgotten, nor will he be as long as the Seminar lasts.

While the Seminar idea was conceived by Mr. Stevens it remained for Prof. P. H. Rolfs to recognize its value and give it form. He and his staff have made it the splendid success which it now is. The Experiment Station is the only institution which could have done it.

As a means of bringing the citrus growers of the State together and imparting and securing exact scientific and other practical information, the Seminar is in a class alone. Matters discussed at these meetings have a most important bearing on the welfare of the industry and State. It is the clearing house for the very latest information on most phases of the business, for it brings the growers together on such a footing that they can easily organize for co-operative work. A grower who once attends is pretty certain to come again and again, year after year.

After the formal opening addresses Tuesday morning, Professor S. E. Collison reported on the results obtained in some citrus fertilizer experiments he has under way. Professor B. F. Floyd gave an unusually interesting report on the relative importance of phosphoric acid and potash in fertilizers. It would seem that phosphoric acid was much more important as a plant food than potash, German propaganda to the contrary notwithstanding. The facts given were striking and convincing.

J. N. Harper explained the effects of the various fertilizer elements and emphasized the necessity of balancing formulas carefully to suit the needs of the crop on the particular soil on which it is growing. Mr. L. M. Rhodes of the State Marketing Bureau explained the work of that organization, defined its field of endeavor and offered its services to all.

In the afternoon Mr. F. L. Skelly discussed the marketing of the 1918 citrus crop. The outlook is indeed bright. J. R. Winston followed with a paper describing a method of "Field Testing of Copper Spray Coatings". Mr. Sanborn next gave an interesting talk on the "Feeding and Care of Chickens". Professor Stevens gave the last paper of the afternoon, entitled, "Citrus Diseases". It contained some new material, the results of investigations just completed.

At the conclusion of the afternoon program the people of Gainesville took the visitors out to inspect the Peanut Mill and the Gillett Oil Company plants north of town. The latter is the only government supported concern in the South for the manufacture of castor oil for the use of government aeroplanes.

The Wednesday program was one of exceptional interest throughout. Professor W. W. Yothers gave a report on "Some Miscellaneous Results". Dr. J. H. Montgomery, head of the Quarantine Department of the State Plant Board, presented this department's work very clearly. It may be described as the first line of defense against invading insect pests and diseases which have not yet succeeded in becoming established in Florida. Already several very destructive pests have been intercepted at points of entry by Quarantine Inspectors, namely the Black Fly, the West Indian Fruit Fly and the Sweet Potato Scarabee. It causes a cold perspiration when one realizes what a narrow escape the State has had from introducing these pests and makes very clear the need of this department.

Dr. Montgomery was followed by Mr. O'Byrne, who spoke on the subject of "Nursery Inspection, Our Second Line of Defense". Some reasons were given for believing that the assistant nursery inspectors in the field were wide awake and alert.

Mr. E. L. Wartmann, member of the State Plant Board, in a few well chosen words, described the work of the Board itself in its efforts to protect the citrus industry in eradicating citrus canker and keeping out other insect pests and diseases. He emphasized the necessity of the farmers and fruit growers supporting the Plant Board and insisting upon the strict enforcement of the Plant Act and the Board's rules.

Mr. Wilmon Newell, Plant Commissioner, gave the opening address of the afternoon session. Though brief, it indicated forcibly the need for such an organization as the Plant Board, to be constantly on the alert to protect the growers' interests. The Black Fly, Pink Bollworm, Mediterranean Fruit Fly and other important pests were discussed and the menace which they offer the State was made very apparent. He also expressed the opinion that the time was near at hand when provision should be made for compulsory control of insects and diseases on private properties.

Immediately following Mr. Newell's talk, Dr. J. H. Ross asked for the floor. He commented on the great benefit derived from the efforts of the State Plant Board to date and stressed the need of a continuance of the work on even broader lines than heretofore.

J. R. Watson described an insect friendly to the grower because an enemy of the whitefly. He has succeeded in establishing this California insect in groves at three points in the State. He also discussed the life history and control of the pumpkin bug.

Mr. W. A. Dopson gave an instructive address on the present labor situation. Dr. Ross gave an interesting talk on "Organization for Grove Work".

At eight o'clock Wednesday evening, Hon. Clarence Ousley, Asst. Secretary of Agriculture, delivered a lecture which was an inspiration to everyone present. While his address was primarily of an agricultural nature, it was also a patriotic address which stirred the large audience to the very depths.

Thursday morning H. Harold Hume spoke on the subject of "War Gardens" and B. C. Skinner of Dunedin discussed the "Use of Tractors in Florida". M. J. Jarnagin discussed "The Feeding and Care of Horses and Mules".

The final number on the morning program was a discussion and demonstration of "The Care and Repair of Spraying Machine Parts". Various makes of spraying machines were backed into the tent where the meeting was held and H. C. Lassen, a spraying machine man himself, went over them one at a time illustrating his talk with the actual parts of the machine under discussion. Nothing finer in its line has ever been given at the Seminar. It was of tremendous practical value to every grower who operates a power sprayer, and that means every progressive grower in the State who has a grove of any considerable size.

The entire afternoon was devoted to a tractor demonstration at Daysville, two miles from Gainesville. Many makes of tractors were represented and each was given a five-acre strip to plow in competition with others. This gave an excellent opportunity for the various tractors to demonstrate their respective advantages. A large crowd spent the entire afternoon watching, questioning and commenting.

The evening was devoted to a patriotic meeting in preparation for the Fourth Liberty Loan, and a splendid patriotic address was given by Mr. Ousley.

Friday morning was the concluding session. As many of the citrus men were gone, the program was merged with the Live-Stock Roundup and subjects were selected which were applicable to both meetings. The program was concluded shortly before noon and the growers left on various trains of the afternoon, declaring to a man that it was the best Seminar they had attended.—F. M. O.

THE QUARTERLY BULLETIN

State Plant Board of Florida

Vol. III JANUARY, 1919 No. 2

REPORT OF THE STATE PLANT BOARD FOR THE BIENNIAL PERIOD ENDING APRIL 30, 1918

(SECOND BIENNIAL REPORT)

AND SUPPLEMENTAL REPORTS

LETTER OF TRANSMITTAL

December 31, 1918.

To His Excellency,
Sidney J. Catts,
Governor of Florida.

SIR: Herewith is submitted the report of the State Plant Board of Florida for the biennium ending April 30, 1918, with supplemental report to September 30, 1918. We request that you submit same to the Legislature.

Respectfully,
STATE PLANT BOARD,
By JOE L. EARMAN,
Chairman.

REPORT OF STATE PLANT BOARD

The work of the State Plant Board has been vigorously prosecuted during the past two years and we believe that the results obtained fully justify the conclusion that the Board has rendered services to the agricultural interests of Florida many times in excess of the amounts expended. In its various lines of work the Board has received unstinted co-operation and support from those most affected by its activities and, on the other hand, has been freely granted the counsel and advice of other agricultural institutions, such as the University of Florida Experiment Station, the State Department of Agriculture, the United States Department of Agriculture and the Federal Horticultural Board.

PERSONNEL OF BOARD

The terms of Messrs. P. K. Yonge, F. E. Jennings and W. D. Finlayson expired on July 2, 1917. Your Excellency appointed, to succeed them as members of the Board, Mr. H. J. Brett, of DeFuniak Springs, Mr. Joe L. Earman, of Jacksonville, and Mr. J. B. Hodges, of Lake City. Mr. Brett was commissioned as a member of the Board on July 8, Mr. Earman on July 2, and Mr. Hodges on July 3, 1917. These gentlemen, together with the two remaining members of the Board, Messrs. E. L. Wartmann, of Citra, and T. B. King, of Arcadia, met at Jacksonville on July

23, organized, and elected Mr. Earman as Chairman. At the same meeting Mr. Bryan Mack, of Pensacola, was elected Secretary, and Mr. J. G. Kellum, of Tallahassee, Auditor. Later in the season Mr. Brett, on account of his duties as a member of the Federal District Board of the Northern District of Florida, found it necessary to resign from the Plant Board, his resignation having been submitted on September 11, 1917. Your Excellency appointed Mr. J. T. Diamond to succeed him and Mr. Diamond was commissioned on September 12, 1917.

ADVISORY COMMITTEE

The Plant Board, when first organized on May 4, 1915, did not find available a suitably qualified person for the position of Plant Commissioner and therefore selected an "Advisory Committee," consisting of Messrs. L. S. Tenny of Orlando, W. J. Krome of Homestead and P. H. Rolfs of Gainesville, this committee acting as Plant Commissioner until the election of Mr. Wilmon Newell to the latter position in July, 1915. Following the election of the Plant Commissioner, the Advisory Committee continued to serve, assisting both the Board and the Commissioner until the Board's work was thoroughly organized and a force of inspectors assembled and trained for the work in hand. The members of this Committee resigned August 14, 1916, after having rendered, without compensation, most valuable service to the Board and to the State of Florida.

CITRUS CANKER ERADICATION

The occurrence of citrus canker in Florida was without doubt the immediate reason for the creation of the State Plant Board by the Legislature, and the Board, immediately upon its organization in May, 1915, was confronted with the tremendous task of bringing this disease under control and eradicating it. In this work, conducted in co-operation with the Bureau of Plant Industry, United States Department of Agriculture, very satisfactory progress has been made. The speed with which the disease has been reduced in the State is indicated by the number of canker infected trees found during the different years. During the year 1915, 6,715 infected trees were found and destroyed; during the year 1916, 2,294 infected trees were found; while during the calendar year 1917 only 372 were found in the entire State. From January 1 to December 31, 1918, 15 infected trees were found. This rate of decrease would indicate that, barring unexpected developments, the disease will probably be eradicated from the State within the next two years if the present campaign is conducted to its logical conclusion.

OTHER IMPORTANT WORK

The efforts of the Plant Board have not been confined by any means to the eradication of citrus canker, but material service has been rendered various agricultural industries in the State in affording them protection from new pests and in controlling many pests already present in different sections.

The banana root borer, an insect destructive to bananas and sugar cane, has during the past year been discovered at three points in the State, and in all three cases prompt eradication measures were undertaken by the Plant Commissioner's forces, in co-operation with the Federal Horticultural Board, and it is believed that these outbreaks have been successfully stamped out.

The sweet potato weevil has made the commercial production of sweet potatoes impossible in several Florida counties. By means of suitable quarantine measures the Plant Board is restricting the further distribution of this pest, thus making possible the continuation of sweet potato culture in the greater portion of Florida.

Severe outbreaks of the semi-tropical army worm in July and August, 1918, threatened to destroy several thousand acres of castor beans being grown under contract for the Government. Active work on the part of the Plant Board inspectors, in co-operation with representatives of the United States Department of Agriculture, resulted in this outbreak being promptly checked and the damage by the pest reduced to a minimum, thus saving for the use of the Bureau of Aircraft Production large quantities of castor beans which would otherwise have been destroyed.

The quarantine work carried on by the Plant Board at the various ports and junction points in Florida is perhaps the most important line of work in which the Board is engaged, and is work which is absolutely essential to the future preservation of many agricultural and horticultural crops in Florida. For example, the quarantine work has thus far been fully effective in keeping out of Florida the black fly, a pest of fruit trees which occurs in Cuba, Jamaica, the Bahamas and the Panama Canal Zone, and which, if introduced into the State, would require probably as heavy expenditures for its eradication as has citrus canker. Many very destructive pests and diseases are kept out of Florida through the efficient work of the Board's quarantine inspectors. In this work the Federal Horticultural Board cooperates, but the State Plant Board is called upon to defray all expenses in connection therewith. The importance of the quarantine work is only fully understood when one realizes the extent to which climatic conditions in Florida permit of the rapid increase and destructiveness of a great variety of insect pests and plant diseases.

The Plant Board has been fortunate in having inspectors and employees who were devoted to the work in hand and who have been exceedingly loyal to the State and its interests. Efficiency has been the sole basis upon which employment has been granted, and in no case has any position been filled for political reasons or through personal favoritism.

The Plant Board has willingly given 75 of its trained employees for service in the Army and Navy of the United States, and has fortunately been able to carry on its work in an efficient manner without replacing these trained men with new and inexperienced ones.

The work being conducted under direction of the Plant Board is of the utmost importance to all agricultural industries in Florida and results directly in substantial increase in many food crops and will, with proper support, be in the future the best safeguard possible for our various agricultural and horticultural industries. This work is deserving of all needed support in the form of appropriations from State funds.

Your Board has given careful consideration to the needs of the agricultural industries of the State for protection and recommends that the sum of $280,630.00 be appropriated for the work of the Plant Board for the coming biennial period, this amount, however, including the $35,000.00 annual continuing appropriation already provided for by Chapter 6885, and being exclusive of amounts required for completing the eradication of citrus canker. The items comprised in this estimate are given on pages 105-108.

For completing the canker eradication work and for such inspection of citrus groves as is necessary to prevent recurrences of the disease, it is estimated that $125,000.00 will be required during the fiscal year ending June 30, 1920, and $100,000.00 during the year ending June 30, 1921, which amounts should be provided, either by appropriation or special taxation.

Further details as to the work done by the Board during the past two years will be found in the Plant Commissioner's report which is transmitted herewith. JOE L. EARMAN,

Chairman.

REPORT OF THE PLANT COMMISSIONER FOR THE BIENNIUM ENDING APRIL 30, 1918

and

SUPPLEMENTAL REPORTS

Hon. Joe L. Earman, Chairman,
State Plant Board of Florida.

SIR: I have the honor to submit herewith my report on the work of the various Departments of the State Plant Board's organization for the two fiscal years ending April 30, 1918, together with a supplementary report covering the period from May 1, 1918, to October 31, 1918.

Respectfully,
WILMON NEWELL,
Plant Commissioner.

It is a pleasure to report that, during the biennium, substantial accomplishments have characterized all lines of work under way or inaugurated by the State Plant Board in accordance with the Florida Plant Act of 1915. The quarantine work at Florida ports has prevented in many instances the introduction of serious insect pests and diseases which are not known to occur in Florida, while the parcel post inspection has prevented the delivery to Florida citizens of many thousands of diseased food-producing and ornamental plants. The progress made in the eradication of citrus canker has been all that could be expected by the most optimistic advocates of this work. The nursery inspection work has been so efficient that no instance has yet come to light of any serious insect pest or plant disease being disseminated from Florida nurseries since the Plant Board commenced its activities. Much has been accomplished in checking the spread of the sweet potato weevil and the Board has been able to maintain, thus far at least, an impenetrable barrier to the entrance of the black fly, a most serious insect pest occurring in Cuba, Jamaica, The Bahamas and the Canal Zone.

On several occasions the organized inspection forces of the Board have been able to give immediate assistance in times of public necessity and have thus been enabled to save many thousands of dollars worth of property in ways not originally contemplated by the Plant Act.

The measures of success attained along these lines must be credited to the broad views and conservative decisions of the Board itself, full co-operation by Florida citizens, and the enthusiastic and loyal service of its employees.

However, the steady and uninterrupted prosecution of the Board's work has not been without difficulties. Constantly increasing salaries for skilled workers and technically trained men have resulted in the Board losing many of its employees, and in the case of many of those remaining, the Board has been compelled, for the preservation of its work, to pay higher salaries than formerly. This, coupled with the tremendously increased cost of all materials and supplies necessary in its work, has made it impossible for the Board to decrease its scale of expenditures as rapidly as was hoped for. In no case, however, have appropriations been exceeded or deficits created.

Increased shipping at Florida ports, coupled with necessary precautions on the part of military and naval authorities, has also greatly increased the difficulties attending our quarantine work.

Military Service

In spite of the fact that the work of the Plant Board is one directly instrumental in conserving and protecting important food crops, it has given its employees ungrudgingly for service in the Army, Navy and Aviation Section. Sixty-nine of its employees are now in such service. Their names will be found on pages 159-160 of The Quarterly Bulletin, Vol. II.

These men have not been replaced by new employees, but those remaining have patriotically exerted every energy with the result that both the scale and efficiency of the work have been maintained and considerable economy effected at the same time.

RULES AND REGULATIONS

The primary purpose of the Plant Board is to prevent the introduction and dissemination of injurious insects and plant diseases and to effect the control and eradication of such. To this end certain quarantine measures are necessary, authority to make and enforce which is vested in the Board by the Plant Act of 1915.

Rules 1 to 27, inclusive, adopted by the Board between May

1, 1915, and October 31, 1916, were submitted with my last report. Since that report the Board has made such amendments to its existing rules as circumstances and experience made advisable and in addition adopted new rules to meet new dangers or new conditions. These rules have been as follows:

Rule 28, prohibiting the importation into Florida from Jamaica, of all pineapples and pineapple plants, to prevent the introduction of the pineapple black weevil, and Rule 29, requiring special treatment of nursery stock shipped from nurseries in sections where the Dictyospermum scale is known to exist, were adopted by the Board on January 8, 1917.

Rule 30, providing for the disposition of infested or infected shipments of nursery stock, adopted February 12, 1917.

Rule 31, specifying the qualifications for inspectors of the Plant Board, and requiring applicants to pass a satisfactory examination prior to employment, adopted April 9, 1917.

Rule 32, regulating the shipment of sweet potato plants and tubers into Florida, to prevent the further introduction of the sweet potato weevil, adopted August 13, 1917.

Rule 33, prohibiting the shipment of sweet potato plants from areas infested by the sweet potato weevil, and Rule 34, regulating the shipment of sweet potato tubers from areas infested by this weevil, in order to prevent its continued spread, were adopted September 13, 1917. Rule 35, prohibiting the pasturing of live stock in citrus canker infected properties, was adopted on the same date.

Rule 36, requiring the disinfection of field boxes by public fruit packing houses, adopted October 8, 1917.

Rule 37, regulating the importation of cotton seed, cotton waste, etc., in order to prevent the introduction into Florida of the pink bollworm of cotton, adopted December 10, 1917.

Rule 38, requiring common carriers and their agents to hold under quarantine prohibited shipments, etc., adopted February 21, 1918.

The above rules and all amendments to rules were published in the "Circulars" of the Board, Nos. 18 to 29 of which, inclusive, were published during the biennium.

All Rules and Public Notices of the Board, as in effect on

April 30, 1918, will be found in Circular No. 30 (issued July 31, 1918).

CITRUS CANKER ERADICATION

The work of eradicating citrus canker has progressed very satisfactorily during the biennium. As heretofore, the work has been carried on in close co-operation with the Bureau of Plant Industry, United States Department of Agriculture, under the direction of the Plant Commissioner, ably assisted by the General Inspector, Mr. Frank Stirling.

For convenience, the work done during the two fiscal years is here treated separately.

YEAR ENDING APRIL 30, 1917

During this period but one new center of infection (at Groveland, Lake County) was discovered.

The number of employees during the year remained practically stationary, the lowest number being 342 in May of 1916, and the largest number 418 in August and September of the same year.

Inspections during the year embraced 17,635,646 citrus trees planted in grove formation and 51,882,397 in nursery formation. Many of these trees were, of course, inspected more than once; the figures given are the total number of tree-inspections.

The area inspected during the year embraced the greater portion of what is generally regarded as the citrus-producing section of the State and also extended to other portions of the State where citrus is not produced in large quantity.

As has been the case at all times since inspection work was undertaken, trees that had been planted from nurseries in which citrus canker was afterwards found have been constantly under close surveillance. It is gratifying to report that as a result of this inspection of suspected shipments, the inspectors were able to find but one infection which had previously been unknown.

Reinspection work has been maintained continuously in properties known to have been infected and all grove properties adjacent to infected areas have been kept under constant observation.

A "scout inspection," that is, inspection of citrus trees in sections not previously inspected, has been carried on as rapidly as conditions in the infected centers permitted and substantial progress has been made in scouting the citrus-producing areas of the State.

During the fiscal year a total of 2,285 grove trees and 483 nursery trees were found infected with citrus canker. These were located on a total of 142 properties in 13 counties. Of the 142 properties in which infected trees were found, 74 had not previously shown infection.

During the year, also, the State Plant Board declared as being "no longer danger centers" with reference to citrus canker, 213 properties previously infected. At the end of the fiscal year there remained 146 properties classed as actively infected.

A full measure of co-operation was received from growers generally. One substantial indication of this co-operation is found in the fact that during the fiscal year owners of trees which had been exposed to infection gave permission for the destruction of 47,584 grove trees and 10,029 nursery trees.

There was expended in the canker eradication work in Florida during the fiscal year a total of $405,390.10, of which amount $393,994.85 was paid out of Federal funds by the Bureau of Plant Industry and $11,395.25 by the State Plant Board. Expenditures by months are shown in the following table:

		Bur. of Plant Industry	State Plant Bd.
May	1916	$ 25,473.80	$ 467.08
June	"	32,233.32	989.65
July	"	37,202.84	317.97
August	"	40,459.02	281.64
September	"	41,818.31	427.88
October	"	35,959.38	706.48
November	"	34,463.36	397.60
December	"	33,751.29	535.73
January	1917	33,639.76	242.68
February	"	19,415.87	5,228.52
March	"	26,203.95	236.79
April	"	33,373.95	1,509.23
		$393,994.85	$11,395.25

Total $405,390.10

Other essential facts concerning the canker eradication work during the year are given in Table I, prepared by Mr. Frank Stirling.

·TABLE I

TABULATED REPORT OF THE CITRUS CANKER ERADICATION DEPARTMENT FOR THE YEAR ENDING APRIL 30, 1917

Prepared by Frank Stirling, General Inspector

	Number of employees on force	Number of trees inspected for citrus canker. (Many trees were reinspected a number of times. The figures below include such reinspections.)		Number of counties in which citrus canker was found.	Number of properties in which citrus canker was found.	Number of trees found infected and destroyed.		Number of "exposed" trees destroyed as a precautionary measure.		Number of properties newly infected	Number of properties declared no longer actively infected.	Number of properties classed as "active infections."
		Grove	Nursery			Grove	Nursery	Grove	Nursery			
1916												
May	342	1,317,262	2,439,000	8	39	338	268	6361	0	9	0	294
June	378	1,716,502	3,307,182	7	53	450	82	2947	0	9	0	303
July	399	1,489,849	7,303,059	9	42	349	46	4848	0	9	19	293
August	418	1,866,807	2,139,361	8	51	219	9	4039	0	9	2	300
Sept.	418	1,819,692	2,153,961	9	44	124	32	7335	0	7	1	306
October	364	1,378,269	1,813,733	8	35	451	11	5759	0	11	164	153
Nov.	389	1,472,639	5,077,603	5	28	131	3	1236	0	4	6	151
Dec.	372	1,362,610	5,756,225	3	12	27	0	4601	0	4	5	150
1917												
January	378	1,396,031	4,095,851	4	11	14	0	4278	10,000	2	8	144
February	368	878,166	5,791,637	4	5	4	3	1453	0	0	4	140
March	365	1,176,830	5,884,266	2	5	9	4	1327	4	0	2	138
April	363	1,760,989	6,120,519	7	24	169	25	3400	25	10	2	146
Totals		17,635,646	51,882,397	13*	142**	2285	483	47584	10,029	74	213	
Totals prior to May 1, 1916				21		11247	341,770	59237	2,539,834	382	97	
Grand totals				22		13532	342,253	106821	2,549,863	456	310	146

*Infections reported from 13 counties for year 1916-17. One newly infected county reported for year 1916-17 (Lake). Total number of counties infected to April 30, 1917, 22.

**Actual number of properties upon which infected trees were found during year 1916-17.

YEAR ENDING APRIL 30, 1918

No new centers of infection were found during the year.

The number of employees engaged in the canker eradication work steadily decreased during the year, the number being 334 in June, 1917, and 220 in April, 1918.

During the fiscal year 13,285,865 citrus trees in grove formation and 51,736,342 in nursery formation were inspected. The inspection of trees previously shipped from nurseries under suspicion was continued during the year but no new centers of infection were found.

Reinspection and scout inspection were continued as during the preceding year and the first scout inspection completed in several counties.

During the year 180 grove trees and 1 nursery tree were found infected. These infected trees were found in 34 properties, located in 7 counties. Of the 34 properties in which infections occurred, 4 had not previously shown infection.

As a result of being in close proximity to infected properties or consisting wholly or in part of trees shipped from infected nurseries prior to the beginning of the eradication work a total of 10,257 grove trees and 80,000 nursery trees were destroyed during the year with the consent of the owners.

During the year 116 additional infected properties were declared by the Board as being no longer danger centers with reference to citrus canker infection.

DECLARING PROPERTIES "CLEAN"

Prior to October, 1917, the Board had taken no action with reference to canker-infected properties other than to declare them as being "no longer danger centers" with reference to canker infection. This action, while releasing the property from many phases of the quarantine and permitting the planting of citrus on adjacent properties, did not remove all restrictions. Work in the property, for example, was still required carried on under certain precautions, and replanting of citrus thereon was prohibited.

In October, 1917, the Board gave careful consideration to 76 properties, formerly infected, and concluded that all danger of further infections in these properties was over. They were accordingly declared "clean" by resolution of the Board, and all restrictions of every character, due to past infections, were

TABLE II

Tabulated Report of the Citrus Canker Eradication Department for the Year Ending April 30, 1918
Prepared by Frank Stirling, General Inspector

	Number of employees on force	Number of trees inspected for citrus canker. (Many trees were reinspected a number of times. The figures below include such reinspections.)		Number of counties in which citrus canker was found.	Number of properties in which citrus canker was found.	Number of trees found infected and destroyed.		Number of "exposed" trees destroyed as a precautionary measure.		Number of properties newly infected	Number of properties declared no longer actively infected.
		Grove	Nursery			Grove	Nursery	Grove	Nursery		
1917											
May	326	1,648,258	7,321,698	6	18	52	1	2142	0	2	7
June	334	1,067,557	5,115,519	5	16	45	0	2690	40,000	0	23
July	322	1,132,645	4,097,421	6	10	39	0	1241	25,000	1	0
August	316	724,548	3,350,419	7	17	30	0	486	0	1	0
Sept.	300	859,511	2,787,141	3	4	6	0	467	15,000	0	1
October	286	1,005,998	2,738,029	1	2	2	0	916	0	0	63
Nov.	269	1,189,627	3,983,727	1	1	1	0	30	0	0	6
Dec.	257	1,165,773	3,673,964	1	1	1	0	277	0	0	5
1918											
January	246	1,374,947	4,407,137	0	0	0	0	1288	0	0	3
February	238	1,224,949	4,776,319	1	1	1	0	359	0	0	1
March	224	1,045,291	4,760,295	1	1	1	0	343	0	0	0
April	220	846,761	4,724,673	1	2	2	0	18	0	0	7
Totals		13,285,865	51.736,342	7*	34**	180	1	10257	80,000	4	116
Totals prior to May 1, 1917				22		13532	342,253	223463	2,531,514	473	310
Grand totals				22		13712	342,254	233720	2,611.514	477	426

*Infections reported from 7 counties for the year 1917-18. No newly infected counties reported for the year 1917-18. Total number of counties infected to April 30, 1918, 22.

**Actual number of properties upon which infected trees were found during year 1917-18.

removed therefrom. Thus they were released for replanting to citrus under normal conditions.

In November, 1917, 1 property was declared clean; in December, 1917, 5; in February, 1918, 9; and in March, 1918, 2, making a total of 93 properties from which during the fiscal year absolutely all restrictions were removed.

There was expended in the canker eradication work during the year a total of $313,807.84, of which amount $187,776.24 was by the Bureau of Plant Industry and $126,031.60 by the State Plant Board. Expenditures by months are shown in the following table:

		Bur. of Plant Industry	State Plant Bd.	
May	1917	$ 28,541.00	$ 252.27	
June	"	29,116.92	1,262.77	
July	"	28,198 08	157.33	
August	"	26,943.31	123.27	
September	"	25,642.80	172 65	
October	"	23,681.53	1,866.52	
November	"	41.30	28,635.62	
December	"	1.00	25,115.19	
January	1918	1.00	25,709.41	
February	"	1.00	24,244.57	
March	"	13,475.10	9,217.28	
April	"	12,133.20	9,274.72	
		$187,776.24	$126,031.60	
Total				$313,807.84

Further details concerning the year's work will be found in Table II.

Figure 1 shows, in graphic form, the number of canker infected trees found each month from May, 1914, to April 30, 1918.

Figure 2 shows the number of canker-infected properties found in the State, and the number of such properties declared no longer danger centers, at the end of each month, from May, 1914, to April 30, 1918.

LEGAL ACTIONS

At the time of my last report, November 30, 1916, warrants had been issued charging four parties with planting citrus trees in areas in which such planting was prohibited by rules of the Board because of danger of infection by citrus canker. Two of the parties thus charged afterwards plead guilty and fines were imposed. The two remaining cases were nolprossed.

During the biennium it has not been necessary to bring either civil or criminal actions in connection with the work of eradicating citrus canker, co-operation on the part of growers having become practically universal.

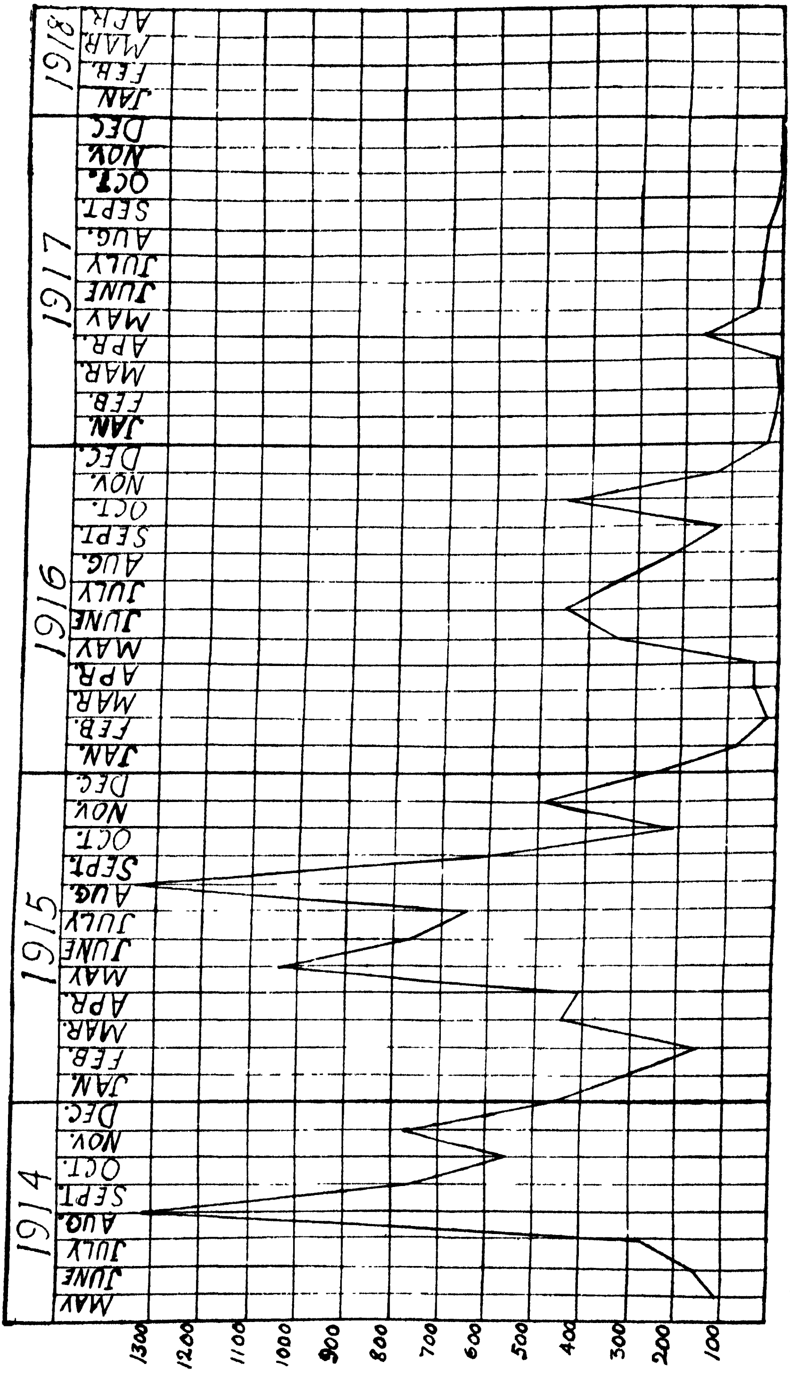

Fig. 1. Diagram showing the number of canker-infected grove trees found in Florida each month from May 15, 1914 (when eradication work was begun by the Florida Growers' and Shippers' League) to April 30, 1918.

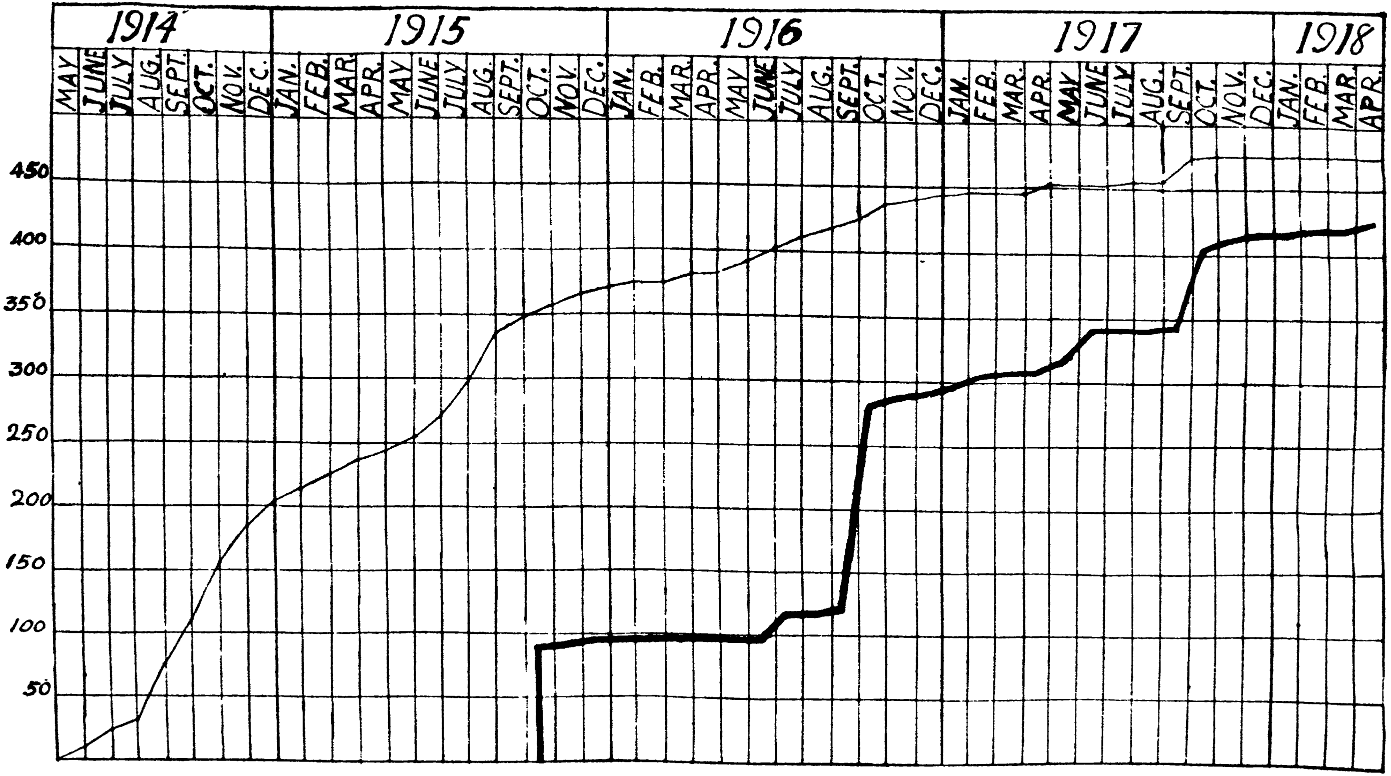

Fig. 2. Comparison of infected properties and properties declared no longer danger centers in Florida at different dates. The upper line shows the total number of canker-infected properties found in the State up to the end of any given month. The lower line shows the number of canker-infected properties declared by the Plant Board, up to corresponding dates, as being no longer danger centers. Complete to April 30, 1918.

Certain actions taken by the Board in connection with violation of the rules and regulations governing the movement of nursery stock are treated of under the head of "Nursery Inspection" on a subsequent page of this report.

SUMMARY

Following are the essential facts concerning the eradication of citrus canker in Florida up to the close of the fiscal year April 30, 1918:

Total number of properties found infected in State		477
Total number declared no longer danger centers		426
Number still classed as active infections on April 30, 1918		51
Number of counties in which citrus canker has been found		22
Total number of grove trees found infected, May 1, 1914, to April 30, 1918		13,712
Total number of nursery trees found infected, May 1, 1914, to April 30, 1918		342,254
Total number of "exposed" grove trees destroyed, May 1, 1914, to April 30, 1918		233,720
Total number of "exposed" nursery trees destroyed May 1, 1914, to April 30, 1918		2,611,514
Amounts expended on canker eradication work in Florida:		
Prior to April 30, 1916:		
Federal funds	$ 56,428.97	
State funds	111,342 34	
From other sources	85,019.62*	
Total		$252,790.93
May 1, 1916, to April 30, 1917 (see p. 37)		405,390.10†
May 1, 1917, to April 30, 1918 (see p. 41)		313,807.84‡
Grand total to April 30, 1918		$971,988.87

The following table shows the number of infected grove trees found in the State from the beginning of eradication work in May, 1914, to April 30, 1918***:

1914		1915		1916		1917		1918	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1
		Mar.	444	Mar.	49	Mar.	9	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2
May	108	May	1042	May	338	May	52		
June	160	June	772	June	450	June	45		
July	275	July	651	July	349	July	39		
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30		
Sept.	767	Sept.	618	Sept.	124	Sept.	6		
Oct.	565	Oct.	214	Oct.	451	Oct.	2		
Nov.	773	Nov.	494	Nov.	131	Nov.	1		
Dec.	366	Dec.	256	Dec.	27	Dec.	1		

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*Includes donations and expenditures from private sources.

†Does not include donations, private expenditures or special salary increases provided by Acts of Congress.

‡For statement of infections May 1-October 31, 1918, see supplemental report (p. 90).

NURSERY INSPECTION

The work of the Nursery Inspection Department has, under the efficient direction of Mr. F. M. O'Byrne, been continued during the biennium along the broad lines originally planned. The work of this Department is two-fold: to prevent the introduction of injurious insects and diseases through nursery stock shipped into the State, and to prevent the dissemination, on or with nursery stock, of pests and diseases already existing within the State. The success and value of the nursery inspection work is determined by the extent to which these objects are attained and it is worthy of note that no instance has yet come to light in which citrus canker has been distributed on nursery stock since the work of this Department was commenced.

For purposes of nursery inspection the State has been divided into thirteen districts. An assistant nursery inspector is assigned to each district, with headquarters therein, and is held responsible for the inspections and other official nursery inspection work in his district. County lines are not considered in forming these districts, the territory in each district being determined by the location of nurseries, available roads and other conditions permitting the most economical management of the work.

Fourteen assistant nursery inspectors are constantly employed, one in each of the thirteen districts and the remaining one assigned to office work, special investigations and emergency inspections. A list of the assistant nursery inspectors on duty April 30, 1918, will be found under the head of "Employees."

Certification may be refused a nursery for any of the following reasons:

Discovery of a new insect pest or disease in the nursery.

Superabundance of any common insect pest or disease.

Presence of an extremely injurious pest or disease.

Exposure of the stock to a highly infectious disease or dangerous insect pest.

Presence in the nursery of a serious pest not generally distributed in the State.

Condition of nursery stock such as to prevent a reliable inspection being made.

Quarantines are imposed upon nurseries when they have become infected with or exposed to extremely dangerous insects, pests, or diseases and, in some cases, when the nurseryman does not comply with the regulations of the Board in a manner insuring safety to his customers. A nursery refused certification or quarantined remains in that status until the dangerous condition has been removed or remedied. In no case is stock certified unless, in the light of all available information, it is safe for distribution and planting.

Nurseries found, upon inspection, to be in a satisfactory condition are certified by the Nursery Inspection Department as being apparently free from especially injurious insect pests and plant diseases. The Florida Plant Act requires that any nursery stock moved from the property on which grown shall have a copy of such certificate attached and anyone owning stock which has been certified may purchase certificate tags from the Nursery Inspector at the actual cost of printing. Printing of certificates by any person other than the Nursery Inspector is prohibited by law.

All certificate tags are serially numbered and the user is required to report the use of each tag by an invoice sent to the Nursery Inspector, this invoice showing the name and address of consignee, date of sale or shipment and the name and number of the trees or plants moved under the tag. The value of such a record has been repeatedly demonstrated. By means of these records, for example, infestations of the banana root borer have been located and the insect eradicated, and when a new avocado disease was discovered in several commercial nurseries, shipments from them were immediately followed up and inspected. Had such records of nursery stock movements been in existence at the time (1913-14) citrus canker was found in Florida, the cost of the campaign against this disease would have been reduced by at least a quarter of a million dollars.

The assistant nursery inspectors have continued their cooperation with the Department of Entomology in collecting colonies of the Vedalia, or Australian lady-bird beetle, for distribution to groves or neighborhoods where cottony cushion-scale occurs. During the biennium ending April 30, 1918, these inspectors collected a total of 2369 of these beneficial beetles and turned them over to the Entomologist.

As in previous years, all host plants of cottony cushion-scale in nurseries located in territory infested by this pest, have been required treated with a suitable insecticide, before shipment, under the direction of an agent of the Plant Board. Agents employed for this purpose are known as "packing-house inspectors" and are paid only for actual time employed. A sum equal to their wages is collected by the Board from the nurserymen for whom service is rendered. The Plant Board incurs no expense by reason of their services. A list of the packing-house inspectors holding appointments at the end of the biennial period will be found under the head of "Employees."

The Nursery Inspector, in co-operation with the Plant Pathologist of the Experiment Station, has had under way for two years a field experiment to determine how citrus scab can be most effectively controlled under nursery conditions. While not yet completed the experiment shows striking results in that trees in the sprayed plots are now larger and more vigorous than those not treated and have been, thus far, free from any scab infection of importance.

LEGAL ACTIONS

At the time of our last report warrants had been issued charging two parties with having moved nursery stock without a certificate of inspection attached, as required by the Plant Act. In both cases further action was suspended during compliance with the rules and regulations of the Board.

During the biennium, information has been filed against eight parties for violating the nursery inspection regulations. In one of these cases the grand jury failed to indict because it did not believe the violation had been committed with criminal intent; in one case prosecution was dropped on recommendation of the prosecuting attorney on account of ignorance, poverty and physical condition of the defendant, and in four cases the defendants plead guilty and were fined. Two cases are pending at the time of this report.

SUMMARY OF WORK DONE

During the two years San Jose scale was found in nurseries on 110 occasions. Shipments from infested blocks were in all cases immediately prohibited and the infestation at once cleaned up under the personal supervision of an assistant nursery inspector.

Camphor thrips was found in 10 nurseries and all shipments of camphor trees therefrom were prepared under direct supervision of an inspector in such way as to eliminate danger of their carrying the pest.

Foot-rot of citrus was found in 8 nurseries. Shipments therefrom were prohibited until the disease had been apparently eradicated from the nursery.

Scaly bark was discovered in localities in 9 counties not previously known to be infected. In all instances the conditions clearly indicated that the disease had been introduced prior to the creation of the Plant Board. These and other known infected areas are described in the Public Notices of the Board with reference to Scaly Bark areas (see Circular 30). Investigations by the Nursery Inspector and his assistants have indicated that Scaly Bark can be transmitted by means of seed from fruit grown in infected groves.

Avocado scab was found in 13 nurseries. Certification was refused in each case, but shipment of trees which were apparently clean was permitted under package certificate after an inspector had personally supervised the selection, treatment and packing.

The banana root-borer was found in one nursery. All banana plants in this and adjacent properties were promptly destroyed with permission and approval of the owners and all other possible steps taken to eradicate the pest.

INSPECTIONS

Year Ending April 30, 1917

Total number of nurseries inspected during year	1503
Total number of inspections made	3427

The acreage in the 1503 nurseries inspected was, on April 30, 1917, as follows:

Citrus	2,081.2	acres
Plum	2.75	"
Pecan	489.25	"
Peach	6.5	"
Ornamental and general	256.	"
Total	2,835.7	"

The amount of stock (number of trees or plants) in the 1503 nurseries on April 30, 1917, was as follows:

Citrus—			
Budded grapefruit	1,744,147		
Budded oranges	3,320,414		
Other budded varieties	283,416		
Unbudded seedlings	12,896,089		
Total citrus stock		18,244,066	
Citrus stock which could not be certified		2,178,484	
Total marketable citrus stock			**16,065,582**

Pecan—			
Budded	346 211		
Seedlings	431,919		
Total pecan stock		778,130	
Pecan stock which could not be certified		152,925	
Total marketable pecan stock			625,205
Peach—			
Budded	43,662		
Seedlings	54,763		
Total peach stock		98,425	
Peach stock which could not be certified		25,300	
Total marketable peach stock			73,125
Plum—			
Budded	10,600		
Seedlings	10,580		
Total plum stock		21,180	
Plum stock which could not be certified		650	
Total marketable plum stock		20,530	
General and Ornamental—			
Total general and ornamental stock	6,484,336		
Stock which could not be certified	295,640		
Marketable general and ornamental stock		6,188,696	
Total marketable stock			22,973,138

Year Ending April 30, 1918

Total number of nurseries inspected during year	2075
Total number of inspections made	5780

The acreage in the nurseries under inspection was, on April 30, 1918, as follows:

Citrus	2,191.1	acres
Plum	5.9	"
Pecan	426.9	"
Peach	11.1	"
Avocado	15.25	"
Ornamental and general	306.	"
Total	2,950.25	"

The amount of stock in the nurseries on April 30, 1918, was as follows:

Citrus—			
Budded grapefruit	1,374,378		
Budded oranges	2,311,534		
Other budded varieties	480,610		
Unbudded seedlings	11,061,622		
Total citrus stock		15,228,144	
Citrus stock refused certification		2,211,392	
Total marketable citrus stock			13,016,752

Pecan—			
Budded	766,050		
Unbudded seedlings	892,900		
Total pecan stock		1,658,950	
Pecan stock refused certification		27,500	
Total marketable pecan stock			1,631,450
Peach—			
Budded	37,700		
Unbudded seedlings	520		
Total peach stock		38,220	
Peach stock refused certification		700	
Total marketable peach stock			37,520
Plum—			
Budded	11,313		
Unbudded seedlings	16,000		
Total plum stock		27,313	
Plum stock refused certification		0	
Total marketable plum stock			27,313
Avocados—			
Budded	64,784		
Unbudded seedlings	129,566		
Total avocado stock		194,350	
Avocado stock refused certification		78,700	
Total marketable avocado stock			115,650
General and Ornamental—			
Total general and ornamental stock		4,764,457	
Stock refused certification		90,652	
Marketable general and ornamental stock			4,673,805
Total stock in Florida nurseries		21,911,434	
Total stock refused certification		2,408,944	
Total marketable stock in Florida nurseries			19,502,490

CERTIFICATES ISSUED

Certificate tags were issued as follows:

Form of Certificate	Total No. tags issued during fiscal year 1916-17				
Regular tags	81,100	to	351	nurseries and	individuals
Stock dealers' tags	8,300	to	27	"	"
Package tags	3,831	to	189	"	"
Scaly bark tags	9,950	to	122	"	"
Truckers' tags	6,700	to	76	"	"
Florida permit tags	35,012	to	185	"	"
Total	144,893		950		

1917-18

Regular tags	55,576	to	329	nurseries and	individuals
Package tags	2,648	to	112	“	“
Stock dealers' tags	6,739	to	21	“	“
Scaly bark tags	1,894	to	43	“	“
Florida permit tags	19,643	to	184	“	“
Truckers' tags	94	to	6	“	“
Total	86,594		695		
Grand total of certificates issued for biennium					231,487

CERTIFICATES REFUSED

During the two fiscal years certificates were refused nurseries as shown below:

Cause	Number of Occasions	
1916-17		
San Jose scale	75	
California red scale	26	
Camphor thrips	9	
Excessive whitefly and scale	568	
Excessive citrus scab	11	
Scaly bark	13	
Dictyospermum scale	40	
Foot rot of citrus	16	
Red banded thrips	1	
Dieback of pecan	1	
Total		760
1917-18		
Avocado scab	52	
San Jose scale	35	
California red scale	47	
Camphor thrips	11	
Excessive whitefly and scale	895	
Excessive amount of citrus scab	1	
Dictyospermum scale	5	
Foot rot of citrus	10	
Red banded thrips	3	
Dieback of pecan	1	
Other causes	116	
Total		1184*

QUARANTINES

Quarantines were imposed upon nurseries as follows:

Cause	Number of Occasions
1916-17	
Citrus canker in nursery	0
Nursery in canker zone or being a “contact” property	122†
Other causes (pests of minor importance, etc.)	4

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*This includes refusals for both commercial and non-commercial nurseries. Some nurseries are practically abandoned and are refused four times a year, once for each inspection made.

†Exclusive of Dade County.

1917-18

Citrus canker in nursery	0
Nursery in canker zone or being a "contact" property	221*
Other causes	6

DEPARTMENT OF PORT AND RAILWAY INSPECTION

One of the principal objects in view in connection with the passage of the Florida Plant Act was protection of the State against the introduction of pests and diseases destructive to crops and fruits. To accomplish this purpose is the object of the Port and Railway Inspection Department of the Plant Board and its work is second in importance to none. Since its inception this work has been under the direct personal supervision of the Plant Commissioner.

During the past two years the Plant Board has become aware of new and increasing dangers from outside sources and as a result has added a considerable number of quarantine regulations, all of which require close inspection work by the Board's inspectors at all important ports of the State as well as at the principal railway centers. During the biennium the Board has greatly strengthened its quarantines against citrus canker and the black fly and has inaugurated quarantine measures against the pink bollworm of cotton. Other quarantines are mentioned on page 79.

In this Department only men of long experience and possessed of technical training can be utilized. All positions are filled by promotion from the Nursery Inspection Department. Many and frequent changes in the personnel of the inspection force have taken place during the past two years. This has been due in part to several of the men being called for military service; and the increased amount of shipping coupled with precautions made necessary on account of the war have made necessary the employment of more men in this work than formerly.

At the present time one Deputy Port and Railway Inspector is stationed at Pensacola, three at Jacksonville, two at Tampa, one at Miami, one at Key West and one at Gainesville, while two additional deputy inspectors, with headquarters at Gainesville, are assigned to special and emergency work.

Deputy inspectors board all vessels arriving at Florida ports and examine cargo, baggage, hand parcels of passengers, and the vessel itself for infected or contraband material. During the two years ending April 30, 1918, our inspectors boarded 7510 vessels, or an average of 313 per month. Shipments arriving on these vessels, to the number of 2822, were inspected. During the same period, 3705 express, freight and wagon shipments were inspected.* The value of this work is shown by the fact that out of the total of 6527 shipments examined, more than one-half were found to be either affected with injurious insects or diseases or were being shipped contrary to rules of the State Plant Board or Federal Horticultural Board and were therefore to be considered dangerous. All such shipments were either destroyed, deported or treated and passed, this in itself a task of magnitude.

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*Dade County included.

All of the inspection work at the ports is done in co-operation with the Federal Horticultural Board, the Deputy Port and Railway Inspectors holding appointments as Collaborators of the Federal Horticultural Board. All expense of this work must be, however, borne by the State, the federal co-operation not extending beyond the granting of authority to the inspectors to enforce federal plant quarantine laws and rules.

In addition to inspection of vessels arriving at our ports, inspectors in this Department frequently inspect material being transported on river steamers, a vast amount of freight entering the State and a very considerable percentage of the express shipments from other states.

The tables following give all essential data regarding this work, together with a list of the insects and diseases intercepted and prevented from entering the State. A number of the interceptions made were of particular importance. For example, the black fly was twice prevented from entering Florida, material from the British West Indies infested with the sweet potato scarabee and many West Indian shipments containing the sweet potato weevil were stopped, as was also a shipment from India bearing a new mango disease and a new mango leaf-infesting insect. In a number of instances scale-insects which are of rare occurrence or lacking in Florida were prevented from entering. Sight should also not be lost of the fact that the existence of plant quarantine rules and their enforcement in Florida has prevented many shipments, now prohibited, that would otherwise have been made into the State, many of which would doubtless have conveyed dangerous pests and diseases.

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*A "shipment" in many cases consisted of many packages, crates or parcels; hence the number of pieces inspected was much in excess of the number of shipments inspected.

REPORT OF INSPECTIONS DURING THE FISCAL YEAR ENDING APRIL 30, 1917

VESSELS INSPECTED:		
From foreign ports	1240	
From U. S. ports other than Florida	658	
From Florida ports	1359	
Total		3257
SHIPMENTS INSPECTED:		
Arriving by water:		
Passed	211	
Treated and passed	54	
Returned to shipper	111	
Detained, subject to return by shipper	25	
Contraband destroyed	1018	
Total		1419
Arriving by land—Express, freight, wagons, etc.:		
Passed	1103	
Treated and passed	188	
Returned to shipper	87	
Detained, subject to return by owner	144	
Contraband destroyed	164	
Total		1686
Total shipments inspected		3105

Principal Pests and Diseases Intercepted

Insect or disease	Occurring on	From	Number of Shipments Infested
Aphis sp.	Geranium	Florida	1
Aspidiotus britannicus	Laurel	Georgia	1
Bamboo borer	Bamboo	Louisiana	2
Birch scale	Birch	Maine	1
Black scale	Hibiscus	Florida	1
Black scale	Jessamine	Florida	1
Black scale	Poinsettia	Florida	1
Cactus scale	Cactus	Florida	1
California red scale	Oleander	Florida	1
Camphor thrips	Camphor	Florida	1
Chaff scale	Citrus	Florida	3
Chaff scale	Palm	Georgia	1
Chaff scale	Unknown shrub	Cuba	1
Chrysomphalus oleae	Palm	Georgia	1
Chrysomphalus sp.	Rose	Virginia	1
Cottony cushion-scale	Citrus	Florida	3
Cottony cushion-scale	Coleus	Florida	2
Cottony cushion-scale	Croton	Florida	1
Crown gall	Grape	Florida	1
Crown gall	Peach	Georgia	2
Crown gall	Peach	New York	1
Crown gall	Peach	Oklahoma	1
Crown gall	Pear	Missouri	1
Crown gall	Rose	Florida	1
Crown gall	Rose	Georgia	2
Crown gall	Rose	New York	1
Crown gall	Rose	Ohio	1
Crown gall	Rose	Pennsylvania	2
Crown gall	Rose	South Carolina	1
Diaspis sp.	Peach	Missouri	1

Insect or disease	Occurring on	From	Number of Shipments Infested
Diaspis sp.	Plum	Missouri	1
Dictyospermum scale	Citrus	New York	2
Dictyospermum scale	Citrus	Spain	2
Dictyospermum scale	Plum	New Jersey	1
Dictyospermum scale	Palm	Pennsylvania	1
Fern scale	Fern	Georgia	1
Fiorinia fioriniae	Camellia	Maine	1
Florida red scale	Camphor	Florida	2
Florida red scale	Citrus	Florida	3
Florida red scale	Magnolia	Florida	1
Florida red scale	Mango	Florida	1
Florida red scale	Palm	Florida	1
Florida wax-scale	Citrus	Florida	1
Florida wax-scale	Mango	Florida	1
Florida wax-scale	Pear	Florida	1
Howard's scale	Gooseberry	Wisconsin	1
Long scale	Citrus	Florida	5
Mango scale	Mango	Florida	2
Mealy-bug	Citrus	Florida	1
Mealy-bug	Citrus	New York	1
Mealy-bug	Coleus	Michigan	1
Mealy-bug	Rose	Florida	1
Mealy-bug	Sugar Apple	Cuba	1
Mealy-bug	Unknown shrub	Cuba	1
Melanose	Citrus	Florida	2
Nematode root-knot	Alamanda	Florida	1
Nematode root-knot	Alamanda	Georgia	1
Nematode root-knot	Apple	North Carolina	1
Nematode root-knot	Australian Silk Oak	Florida	1
Nematode root-knot	Cassava	Florida	1
Nematode root-knot	Cherry	Georgia	1
Nematode root-knot	Chinese Medicine Plant	Florida	1
Nematode root-knot	Chrysanthemum	Florida	1
Nematode root-knot	Fig	Florida	11
Nematode root-knot	Fig	Georgia	10
Nematode root-knot	Fig	North Carolina	1
Nematode root-knot	Fig	South Carolina	7
Nematode root-knot	Fig	Texas	1
Nematode root-knot	Grape	Georgia	2
Nematode root-knot	Grape	New York	1
Nematode root-knot	Hibiscus	Florida	5
Nematode root-knot	Jessamine	Florida	1
Nematode root-knot	Laurel	Georgia	1
Nematode root-knot	Mulberry	Florida	2
Nematode root-knot	Papaya	Florida	1
Nematode root-knot	Peach	Florida	6
Nematode root-knot	Peach	Georgia	7
Nematode root-knot	Peach	Missouri	2
Nematode root-knot	Peach	Oklahoma	1
Nematode root-knot	Peach	South Carolina	1
Nematode root-knot	Pecan	Florida	1
Nematode root-knot	Plum	Florida	1
Nematode root-knot	Plum	Oklahoma	1
Nematode root-knot	Plumbago	Florida	3
Nematode root-knot	Poinsettia	Florida	1
Nematode root-knot	Rose	Georgia	1
Nematode root-knot	Rose	South Carolina	1

Insect or disease	Occurring on	From	Number of Shipments Infested
Nematode root-knot	Rose	West Virginia	1
Nematode root-knot	Unknown shrub	Georgia	2
Nematode root-knot	Unknown plant	Florida	2
Oleander scale	Citrus	New York	2
Oyster-shell scale	Birch	Maine	1
Oyster-shell scale	Maple	Pennsylvania	1
Papaya fruit-fly	Papaya	Cuba	1
Papaya fruit-fly	Papaya	Florida	6
Peach scale	Peach	Florida	1
Peach tree borer	Peach	Georgia	1
Peach tree borer	Peach	Missouri	1
Peach tree borer	Peach	Tennessee	1
Peach tree borer	Plum	South Carolina	1
Phomopsis sp.	Mango	India	1
Purple scale	Citrus	Cuba	1
Purple scale	Citrus	Florida	19
Putnam's scale	Peach	Missouri	1
Putnam's scale	Plum	Missouri	1
Red spider	Rose	Cuba	3
Rufus scale	Tamarind	Cuba	1
Rufus scale	Unknown plant	Cuba	2
San Jose scale	Apple	Georgia	2
San Jose scale	Cherry	Georgia	1
San Jose scale	Cherry	Kentucky	1
San Jose scale	*Crataegus* sp.	North Carolina	1
San Jose scale	Currant	New Jersey	1
San Jose scale	Mulberry	Florida	1
San Jose scale	Peach	Florida	2
San Jose scale	Peach	Georgia	6
San Jose scale	Peach	Illinois	2
San Jose scale	Peach	Indiana	1
San Jose scale	Peach	Kentucky	1
San Jose scale	Peach	Missouri	1
San Jose scale	Peach	New Jersey	1
San Jose scale	Peach	South Carolina	1
San Jose scale	Pear	Florida	2
San Jose scale	Pear	Indiana	1
San Jose scale	Plum	Florida	2
San Jose scale	Plum	Georgia	4
San Jose scale	Plum	Illinois	1
San Jose scale	Plum	Missouri	1
San Jose scale	Poplar	Georgia	1
San Jose scale	Prune	Illinois	1
San Jose scale	Rose	Florida	1
San Jose scale	Rose	Georgia	1
San Jose scale	Unknown shrub	Georgia	1
Snow scale	Hibiscus	Florida	4
Snow scale	Soursop	Cuba	2
Snow scale	Soursop	Mexico	1
Snow scale	Unknown shrub	Florida	1
Soft brown scale	Citrus	Florida	1
Soft brown scale	Hibiscus	Florida	3
Soft brown scale	Laurel	Georgia	1
Strawberry leaf-roller	Strawberry	Wisconsin	1
Sugar-cane borer	Sugar-cane	Cuba	2
Turtle-back scale	Jessamine	Florida	1
Whitefly	Avocado	Florida	3
Whitefly	Citrus	Cuba	2

Insect or disease	Occurring on	From	Number of Shipments Infested
Whitefly	Citrus	Florida	17
Whitefly	Coleus	Florida	1
Whitefly	Guava	Florida	2
Whitefly	Citrus	Honduras	1
Whitefly	Jessamine	Florida	4
Whitefly	Jessamine	Georgia	1
Whitefly	Privit	Florida	1
Whitefly	Privit	Georgia	1
Whitefly	Hibiscus	Florida	3
Withertip	Citrus	Cuba	2
Withertip	Citrus	Florida	1

REPORT OF INSPECTIONS DURING THE FISCAL YEAR ENDING APRIL 30, 1918

VESSELS INSPECTED:		
From foreign ports	1777	
From U. S. ports other than Florida	982	
From Florida ports	1494	
Total		4253
SHIPMENTS INSPECTED:		
Arriving by water:		
Passed	302	
Treated and passed	22	
Returned to shipper	126	
Detained, subject to return by shipper	6	
Contraband destroyed	947	
Total		1403
Arriving by land—Express, freight, wagons, etc.:		
Passed	1077	
Treated and passed	77½	
Returned to shipper	359	
Detained, subject to return by shipper	415	
Contraband destroyed	90½	
Total		2019
Total shipments inspected		3422

Principal Pests and Diseases Intercepted

Insect or disease	Occurring on	From	Number of Shipments Infested
Aphis sp.	Chrysanthemum	Cuba	1
Aphis sp.	Hibiscus	Cuba	1
Aphis sp.	Rose	New York	1
Aspidiotus britannicus	Cocoa palm	Florida	1
Aspidiotus hederae	Chinaberry	Florida	1
Aspidiotus lataniae	Chinaberry	Florida	1
Aspidistra scale	*Anthurium* sp.	Illinois	1
Aspidistra scale	Unknown plant	Illinois	1
Bephrata cubensis	Soursop	Cuba	1
Black Scale	*Eugenia malaccensis*	Cuba	1
Black Scale	Gardenia	Pennsylvania	1

Insect or disease	Occurring on	From	Number of Shipments Infested
Black Scale	*Hoffmannia* sp.	Illinois	1
Black Scale	Poinsettia	Cuba	1
Black Scale	Sago palm	Cuba	1
Boisduval's scale	*Billbergia* sp.	Illinois	1
Boisduval's scale	*Karatas princeps*	Illinois	1
Boisduval's scale	Palm	New York	1
Boisduval's scale	Unknown plant	Illinois	1
Cactus scale	Cactus	Cuba	1
Camphor thrips	Camphor	Florida	1
Cherry scale	Peach	South Carolina	1
Citrus scab	Citrus	Spain	1
Cloudy-winged white-fly	Citrus	Cuba	1
Corn weevil	Corn	Mexico	1
Chaff scale	Citrus	Cuba	2
Citrus mealy-bug	Guava	Florida	1
Coccus sp.	*Miconia magnifica*	Illinois	1
Cocoanut mealy-bug	Cassava	Cuba	1
Cocoanut mealy-bug	*Ochrocarpus africanus*	Cuba	1
Cocoanut mealy-bug	Palm	Cuba	1
Crown gall	Alva bush	North Carolina	1
Crown gall	Apple	Georgia	2
Crown gall	Currant	New York	1
Crown gall	Peach	Georgia	1
Crown gall	Peach	South Carolina	1
Crown gall	Plum	Ohio	1
Crown gall	Raspberry	New York	1
Crown gall	Rose	Cuba	1
Crown gall	Rose	Florida	2
Crown gall	Rose	New York	2
Crown gall	*Rubus* sp.	Iowa	1
Cyanophyllum scale	*Miconia magnifica*	Illinois	1
Cyanophyllum scale	Palm	Connecticut	1
Cyanophyllum scale	Palm	Cuba	1
Cyanophyllum scale	Palm	New York	1
Dictyospermum scale	*Acanthorhiza aculeata*	Illinois	1
Dictyospermum scale	*Anthurium* sp.	Illinois	1
Dictyospermum scale	Bahia	Cuba	1
Dictyospermum scale	*Billbergia* sp.	Illinois	1
Dictyospermum scale	*Eugenia malaccensis*	Cuba	1
Dictyospermum scale	Jessamine	Cuba	1
Dictyospermum scale	Mango	Florida	1
Dictyospermum scale	Palm	New York	2
Dictyospermum scale	Unknown plant	Illinois	1
Florida red scale	Citrus	Cuba	2
Florida red scale	Citrus	Florida	1
Florida red scale	Cocoa palm	Florida	1
Florida red scale	*Ficus* sp.	Florida	1
Florida red scale	*Ficus* sp.	Illinois	1
Florida red scale	Herbaceous plant	Florida	1
Florida red scale	Palm	Connecticut	1
Florida red scale	Palm	Cuba	1
Florida red scale	Palm	New York	1
Florida red scale	Rose	Cuba	1
Florida red scale	Rubber plant	Florida	1
Florida wax-scale	Ivy	Georgia	1
Greedy scale	Privet	Alabama	1
Greedy scale	Rose	Florida	1

Insect or disease	Occurring on	From	Number of Shipments Infested
Green shield-scale	*Anthurium* sp.	Illinois	1
Hairy root	Euonymus	Alabama	1
Hemispherical scale	Sago palm	Cuba	1
Ivy scale	Ivy	Georgia	1
Latania scale	Pecan	Georgia	1
Latania scale	Sapodilla	Florida	1
Latania scale	Unknown plant	Cuba	1
Lesser snow scale	Bahia	Cuba	1
Lesser snow scale	Cassava	Cuba	1
Lesser snow scale	Mango	Florida	1
Lesser snow scale	Palm	Cuba	1
Long scale	Citrus	Cuba	3
Long scale	Citrus	Florida	2
Mango scale	Mango	Cuba	1
Mealy-bug	*Metrosideros floribunda*	Pennsylvania	1
Mealy-bug	*Miconia magnifica*	Illinois	1
Mealy-bug	Palm	Connecticut	1
Mealy-bug	Palm	Florida	1
Mealy-bug	Rose	Cuba	1
Mealy-bug	Sago palm	Cuba	1
Melanose	Citrus	Cuba	1
Melanose	Citrus	Florida	1
Mining scale	*Casuariva stricta*	Cuba	1
Mining scale	*Jacobina mohintli*	Cuba	1
Mulberry whitefly	Holly	North Carolina	1
Nematode root-knot	Fig	Alabama	1
Nematode root-knot	Fig	Cuba	1
Nematode root-knot	Fig	Florida	8
Nematode root-knot	Fig	Georgia	6
Nematode root-knot	Fig	South Carolina	1
Nematode root-knot	Grape	Florida	1
Nematode root-knot	Hibiscus	Alabama	1
Nematode root-knot	Japonica	Georgia	1
Nematode root-knot	Mulberry	Iowa	1
Nematode root-knot	Peach	Florida	2
Nematode root-knot	Peach	Georgia	2
Nematode root-knot	Peach	South Carolina	1
Nematode root-knot	Rose	Florida	3
Nematode root-knot	Rose	New York	1
Nematode root-knot	Spirea	Florida	1
Oleander scale	Brunfelsia	Cuba	1
Oleander scale	Japonica	Cuba	1
Oleander scale	Lantana	Cuba	1
Oleander scale	Mammee apple	Cuba	1
Oleander scale	*Ochrocarpus africanus*	Cuba	1
Oleander scale	Palm	Cuba	1
Oleander scale	Sago palm	Cuba	1
Orthezia insignis	Chrysanthemum	Cuba	1
Oyster-shell scale	Snowball	Pennsylvania	1
Oyster-shell scale	Willow	New York	1
Papaya fruit-fly	Papaya	Florida	1
Peach borer	Peach	Georgia	1
Perforated palm scale	Palm	Connecticut	1
Pineapple scale	*Billbergia* sp.	Illinois	1
Pineapple scale	Dracena	Illinois	1
Pineapple scale	Pineapple	Cuba	1
Purple scale	Citrus	Cuba	6

Insect or disease	Occurring on	From	Number of Shipments Infested
Purple scale	Citrus	Florida	6
Purple scale	Mango	Florida	1
Putnam's scale	*Acer* sp.	Ohio	1
Putnam's scale	Apple	Ohio	1
Red bay scale	Unknown plant	Cuba	1
Rose scale	Raspberry	Iowa	1
Rose scale	Rose	Mississippi	1
Rose scale	Rose	New York	1
Rufous scale	Brunfelsia	Cuba	1
Rufous scale	Citrus	Cuba	3
Rufous scale	Croton	Cuba	1
Rufous scale	Pandanus	Cuba	1
San Jose scale	Apple	Georgia	2
San Jose scale	Apple	New York	1
San Jose scale	Cherry	Massachusetts	1
San Jose scale	Cherry	New York	1
San Jose scale	Cherry	Georgia	1
San Jose scale	Currant	Massachusetts	1
San Jose scale	Jasmine	Florida	1
San Jose scale	Lilac	Origin unknown	1
San Jose scale	Peach	Alabama	1
San Jose scale	Peach	Florida	2
San Jose scale	Peach	Georgia	4
San Jose scale	Peach	Massachusetts	1
San Jose scale	Peach	Michigan	1
San Jose scale	Peach	Ohio	1
San Jose scale	Peach	South Carolina	3
San Jose scale	Peach	Tennessee	1
San Jose scale	Pear	Georgia	4
San Jose scale	Pear	South Carolina	1
San Jose scale	Pecan	Florida	1
San Jose scale	Persimmon	Georgia	1
San Jose scale	Plum	Florida	2
San Jose scale	Plum	Georgia	4
San Jose scale	Plum	Kentucky	1
San Jose scale	Plum	North Carolina	1
San Jose scale	Plum	South Carolina	1
San Jose scale	Plum	Pennsylvania	2
San Jose scale	Rose	Florida	2
San Jose scale	Rose	Georgia	1
San Jose scale	Unknown plant	North Carolina	1
Snow scale	Citrus	Florida	1
Soft brown scale	Acalypha	Florida	1
Soft brown scale	Chrysanthemum	Florida	1
Soft brown scale	Guava	Florida	1
Soft brown scale	Ivy	Georgia	1
Soft brown scale	Lily	Florida	1
Soft brown scale	Maguey	Florida	1
Soft brown scale	Pseuderanthemum	Cuba	1
Soft scale	*Ficus* sp.	Illinois	1
Soft scale	*Pinanga* sp. (Palm)	Illinois	1
Spiny citrus whitefly	Citrus	Cuba	1
Sweet potato root weevil	Sweet potato	Cuba	9
Sweet potato scarabee	Sweet potato	St. Lucie, B.W.I.	1
Tree-hopper	Camphor	Florida	1
Walnut scale	Cherry	Indiana	1
Walnut scale	Cherry	Massachusetts	1

Insect or disease	Occurring on	From	Number of Shipments Infested
Walnut scale	Grape	New York	1
Walnut scale	Peach	Florida	1
Walnut scale	Peach	Massachusetts	1
Walnut scale	Peach	New York	2
Walnut scale	Pear	New York	1
Walnut scale	Plum	New York	2
Walnut scale	Chinaberry	Florida	1
Whitefly	Citrus	Alabama	1
Whitefly	Citrus	Cuba	2
Whitefly	Citrus	Florida	3
Whitefly	Jasmine	Florida	3
Whitefly	Jasmine	Georgia	1
Whitefly	Jasmine	South Carolina	1
Whitefly	Privet	Alabama	1
Whitefly	Privet	South Carolina	1
White peach scale	Bahia	Cuba	1
Withertip	Citrus	Florida	1
Wooly apple aphis	Apple	Georgia	1

PARCEL POST INSPECTION

Within a few months after its organization the Plant Board was able to practically put a stop to shipments of infested material into the State by freight or express. However, the mails still remained open to unscrupulous or careless people in other states as an avenue through which diseased trees and plants could be unloaded upon Florida citizens.

To meet this condition the Plant Board made application to the Postoffice Department for the privilege of inspecting mail shipments of plants and plant products, addressed to Florida postoffices, under the provisions of the Act of Congress of March 4, 1915, and embodied in Section 478¼, Postal Laws and Regulations. After considerable preliminary correspondence, most of which had to do with agreement on the classes of material to be made subject to inspection, the Third Assistant Postmaster General, on October 24, 1916, issued an order providing for the inspection, by agents of the Plant Board, of all trees, plants, shrubs, vines, cuttings and certain other plant materials consigned to Florida postoffices. Under this order parcel post material subject to inspection was required sent to the postoffice at Gainesville for inspection. Later, arrangements were made for similar inspections at the postoffices at Pensacola, Jacksonville and Tampa and inspection facilities are maintained at the four postoffices named at the present time. The orders, rules, etc., of the Postoffice Department, authorizing such inspection, will be found in Circular 30 of the Plant Board.

As soon as inspection of mail matter was commenced it was found that large quantities of infested and diseased plants were being shipped into the State. Between November 1, 1916, when this inspection service was commenced, and April 30, 1917, 4138 mail shipments were inspected and of this number 579 were found undeliverable on account of plants in the shipments being infested or diseased. Also 72 parcels were treated and passed. During the twelve months ending April 30, 1918, 5045 parcels were similarly inspected, of which 266 were non-deliverable in the condition in which they were received because of containing dangerous insects or plant diseases. There were 220 treated and passed and the remainder returned to senders or destroyed.

The inspection of mail shipments has prevented the delivery to Florida citizens of many thousands of insect-ridden and diseased plants and, in final results, has prevented losses running into many thousands of dollars.

But one unfortunate feature has characterized this work and that has been the failure on the part of many postmasters to do their part by complying with the orders of the Postoffice Department in this matter. Through their negligence or indifference, many shipments have been delivered direct to Florida citizens when these shipments should have first been sent by the postmaster for inspection. As a partial remedy for this condition, your Plant Commissioner recommends that sufficient funds be made available for this work so that special representatives of the Plant Board may be assigned to the duty of keeping check on the postmasters who are negligent in this matter.

The following tables give the results of the parcel post inspection work for the biennium:

PARCEL POST PLANT INSPECTION
Fiscal Year Ending April 30, 1917
(Nov. 4, 1916, to April 30, 1917)

PARCELS INSPECTED:		
Passed	3487	
Treated and passed	72	
Returned to sender	552	
Detained, subject to return	13	
Infested or infected parcels destroyed	14	
Total Parcels Inspected		4138

Principal Pests and Diseases Intercepted

Insect or disease	Occurring on	From	Number of Parcels Infested
Borer	Walnut	Georgia	1
Chaff scale	Citrus	Ohio	1
Crown gall	Apple	Nebraska	1
Crown gall	Rose	Ohio	18
Dictyospermum scale	Rubber	Ohio	1
Florida red scale	Citrus	Florida	1
Long scale	Citrus	Florida	1
Melanose	Citrus	Florida	1
Nematode root-knot	Begonia	Ohio	10
Nematode root-knot	*Cissus discolora*	Ohio	1
Nematode root-knot	Coleus	Ohio	2
Nematode root-knot	Chrysanthemum	Ohio	16
Nematode root-knot	Chrysanthemum	Florida	1
Nematode root-knot	Cyclamen	Ohio	1
Nematode root-knot	Daisy	Ohio	16
Nematode root-knot	Fig	Florida	4
Nematode root-knot	Geranium	Florida	1
Nematode root-knot	Geranium	Ohio	19
Nematode root-knot	Grape	Tennessee	1
Nematode root-knot	Hibiscus	Ohio	17
Nematode root-knot	Honeysuckle	Ohio	3
Nematode root-knot	Ivy	Ohio	1
Nematode root-knot	Lemon verbena	Ohio	2
Nematode root-knot	Primula obconica	Ohio	1
Nematode root-knot	Peach	Georgia	1
Nematode root-knot	Peony	Ohio	1
Nematode root-knot	Rose	Florida	2
Nematode root-knot	Rose	Georgia	1
Nematode root-knot	Rose	Indiana	1
Nematode root-knot	Rose	Ohio	511
Nematode root-knot	Rose	Pennsylvania	1
Nematode root-knot	Rose	North Carolina	1
Nematode root-knot	Salvia	Ohio	1
Nematode root-knot	Tomato	Florida	2
Nematode root-knot	Tomato	Georgia	1
Nematode root-knot	Violet	Ohio	1
Nematode root-knot	Wisteria	Ohio	1
Purple scale	Citrus	Florida	5
San Jose scale	Chinaberry	Florida	1
San Jose scale	Peach	Illinois	1
San Jose scale	Rose	Florida	1
Whitefly	Citrus	Florida	2
Whitefly	Citrus	Ohio	1

Fiscal Year Ending April 30, 1918

PARCELS INSPECTED:

Passed	4779	
Treated and passed	220	
Returned to sender	4	
Detained, subject to return by sender	27	
Infested or infected parcels destroyed	15	
Total Parcels Inspected		5045

Pests Intercepted

Insect or disease	Occurring on	From	Number of Shipments Infested
Bruchus sp.	Cow peas	Florida	1
Citrus mealy-bug	Citrus	Pennsylvania	1
Citrus mealy-bug	Coleus	Ohio	6
Crown gall	Peach	Georgia	1
Crown gall	Rose	Illinois	1
Crown gall	Rose	Ohio	13
Dictyospermum scale	Palm	New Jersey	1
Florida red scale	Palm	New Jersey	1
Florida wax-scale	Ivy	New York	1
Ivy scale	Ivy	New York	1
Lace bug	Rhododendron	Tennessee	1
Mealy-bug	Coleus	Ohio	1
Mealy-bug	Hibiscus	Ohio	1
Mealy-bug	Rose	Ohio	1
Mealy-bug	Salvia	Ohio	1
Melanose	Citrus	Florida	1
Nematode root-knot	Begonia	Illinois	1
Nematode root-knot	Begonia	Ohio	6
Nematode root-knot	Canna	New York	1
Nematode root-knot	Chrysanthemum	Ohio	10
Nematode root-knot	*Clematis paniculata*	New York	1
Nematode root-knot	Coleus	Ohio	4
Nematode root-knot	Discorea	Illinois	1
Nematode root-knot	Fig	Florida	2
Nematode root-knot	Geranium	Florida	1
Nematode root-knot	Geranium	New York	1
Nematode root-knot	Geranium	Ohio	27
Nematode root-knot	Grape	Florida	1
Nematode root-knot	Grape	Pennsylvania	1
Nematode root-knot	Hibiscus	Ohio	9
Nematode root-knot	Kudzu vine	Ohio	1
Nematode root-knot	Lemon verbena	Ohio	4
Nematode root-knot	Lilac	Ohio	1
Nematode root-knot	Peach	Florida	1
Nematode root-knot	Petunia	Ohio	2
Nematode root-knot	Plum	Florida	1
Nematode root-knot	Plumbago	Ohio	1
Nematode root-knot	Rose	Florida	1
Nematode root-knot	Rose	Illinois	1
Nematode root-knot	Rose	New York	1
Nematode root-knot	Rose	Ohio	150
Nematode root-knot	Snowball	Ohio	1
Nematode root-knot	Tomato	Florida	2
Nematode root-knot	Unknown plant	Kentucky	1
Nematode root-knot	Unknown shrub	South Carolina	1
Nematode root-knot	Wistaria	Ohio	1
Oleander scale	Oleander	Ohio	1
Oyster-shell scale	Willow	New York	1
Rose scale	Raspberry	Iowa	1
San Jose scale	Peach	Kentucky	1
San Jose scale	Peach	Ohio	1
San Jose scale	Pear	Ohio	1
San Jose scale	Plum	Florida	1
San Jose scale	Plum	Ohio	1
San Jose scale	Rose	South Carolina	1
Soft brown scale	Ivy	New York	1
Whitefly	Citrus	Florida	1
Whitefly	Jasmine	Florida	1

NEEDED LEGISLATION

While the Florida Plant Act of 1915 is very broad and while its provisions cover practically all situations likely to arise in connection with the Plant Board's work, experience has shown the desirability of amendments in two respects.

Cases have occurred where there has been some question as to the court in which criminal proceedings should be brought and some prosecuting attorneys have taken advantage of this to decline, or shift, the responsibility for making prosecutions.

Some difficulty has been experienced, particularly in the quarantine work, with parties attempting, through threats and abusive language, to intimidate the Plant Board's agents and prevent their proper performance of duty. While the general statutes afford relief in the case of actual assault upon the inspectors, an adequate remedy is not at hand for dealing with attempts at intimidation.

Your Plant Commissioner accordingly recommends that legislation be requested providing:

(1) That prosecutions for violation of provisions of the Florida Plant Act of 1915, or for violation of the rules and regulations of the Plant Board may be made in any county of the State affected by such violations, and

(2) A severe penalty for interfering with or intimidating any agent of the State Plant Board when engaged in the discharge of his official duties.

SWEET POTATO WEEVIL

In several counties of the State the sweet potato weevil has caused the abandonment of commercial cultivation of the sweet potato and has, in fact, made it well-nigh impossible for farmers to produce enough potatoes for their own use. All counties which are generally infested with this insect are importers, rather than exporters, of sweet potatoes.

As the normal sweet potato crop of Florida is between three and one-half and four million bushels annually*, and as the weevil is readily carried to new localities in either tubers or plants, the seriousness of the situation is at once apparent. Continued spread of the pest will ultimately mean that but few sweet potatoes will be grown in Florida.

The presence of this insect in southern Florida was known at the time the Plant Board was created in 1915, but the urgency of the citrus canker situation, coupled with the necessity for assembling and training a corps of inspectors, made it impossible to give the weevil problem immediate attention.

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*The crop of 1915-16 was 3,859,107 bushels.

As soon as the work of eradicating citrus canker was well under way and it was seen that substantial headway was being made against the disease, attention was given, as far as the means of the Board permitted, to the sweet potato weevil situation.

Several reports of the insect's occurrence in Dade County were received during 1916 and reference was found in publications of the U. S. Department of Agriculture to its occurrence in Manatee County in earlier years.

In December, 1916, the entomologist of the Experiment Station, Mr. J. R. Watson, received specimens of the weevil from Mr. Wm. A. Dopson, of Sanderson, Baker County. Subsequent investigation by Mr. K. E. Bragdon, inspector for the Plant Board, showed the insect present in the neighborhood of Sanderson, Glen St. Mary and Macclenny, all in Baker County. Growers reported that the insect had been present for about three years. Damage to the sweet potato crop in 1916 was very severe, 30% to 50% of the crop being in many instances destroyed while still in the field and the remainder destroyed by the weevils after digging and storing in houses or banks.

In June, 1917, the weevil was found in Broward and Palm Beach Counties, in July and August in Lee, Monroe and St. Lucie Counties, and in October in Volusia County.

In October, 1917, an isolated infestation was found at Citrus Park, Hillsborough County, and as only a few farms were infested, an attempt was immediately made by the Board, in cooperation with the owners, to eradicate the pest at this point. Subsequent investigation showed that the insect had been brought to Citrus Park the year previous in roots of the seaside morning glory which were planted as ornamentals. It was found that these morning glory roots had been taken from a point on Tampa Bay where the morning glories were heavily infested with the weevil.

As the insect was known to be generally distributed through the West Indies and known to occur in Louisiana and Texas, the Plant Board, on July 23, 1917, adopted Rule 32, prohibiting the importation into Florida of sweet potato tubers and plants and morning glory roots and plants (with certain exceptions in the case of new varieties for propagation), as a means of preventing further introductions of the pest. At the same time a Public Notice was issued by the Board, defining the areas in Florida known to be infested and Rules 33 and 34, regulating the shipment of sweet potato and morning glory tubers and plants out of the infested areas, were adopted. These rules have been found very effective in checking the spread of the weevil and have been amended from time to time as occasion required. The Public Notice and the Rules referred to will be found in Circular 30. Similar rules and regulations were shortly afterwards adopted by the States of Alabama, Georgia and South Carolina.

In October, 1917, a rather full account of the sweet potato weevil, and the measures to be used in reducing its damage, was published in the Quarterly Bulletin of the Plant Board.

FEDERAL CO-OPERATION

On July 1, 1917, Dr. F. H. Chittenden, of the Bureau of Entomology, U. S. Department of Agriculture, and your Plant Commissioner held a conference regarding the situation and the conclusion reached that a campaign of control and eradication was not only feasible and practical but would result in very materially increasing the sweet potato crop of the Southern States. The matter was accordingly placed before the Honorable Secretary of Agriculture, with the result that $10,000 was set aside out of the sum allotted for the suppression of insects injurious to truck crops, available under the provisions of the Food Production Act, approved August 10, 1917, this sum to be used by the Bureau of Entomology in preliminary survey work and demonstration methods in the states where the weevil occurred. As a part of this program, Agent O. K. Courtney of the Bureau was sent to Florida in January, 1918, to co-operate with the Plant Board.

In April, 1918, additional funds having been made available for the Bureau, a field laboratory was established at Macclenny, Baker County, for the study of the weevil and for experiments in improving the methods of control.

TERRITORY INFESTED

Through the fall, winter and spring months, inspections were made by the Bureau agents and by the Plant Board inspectors, with the result that the weevil is now known to occur in Baker, Volusia, Brevard, St. Lucie, Palm Beach, Broward, Dade, Monroe, Lee, DeSoto, Manatee, Hillsborough and Pinellas Counties. The infestations in nearly all cases were found to be of comparatively long standing. Parts of Georgia, Alabama and Mississippi have also been found infested.

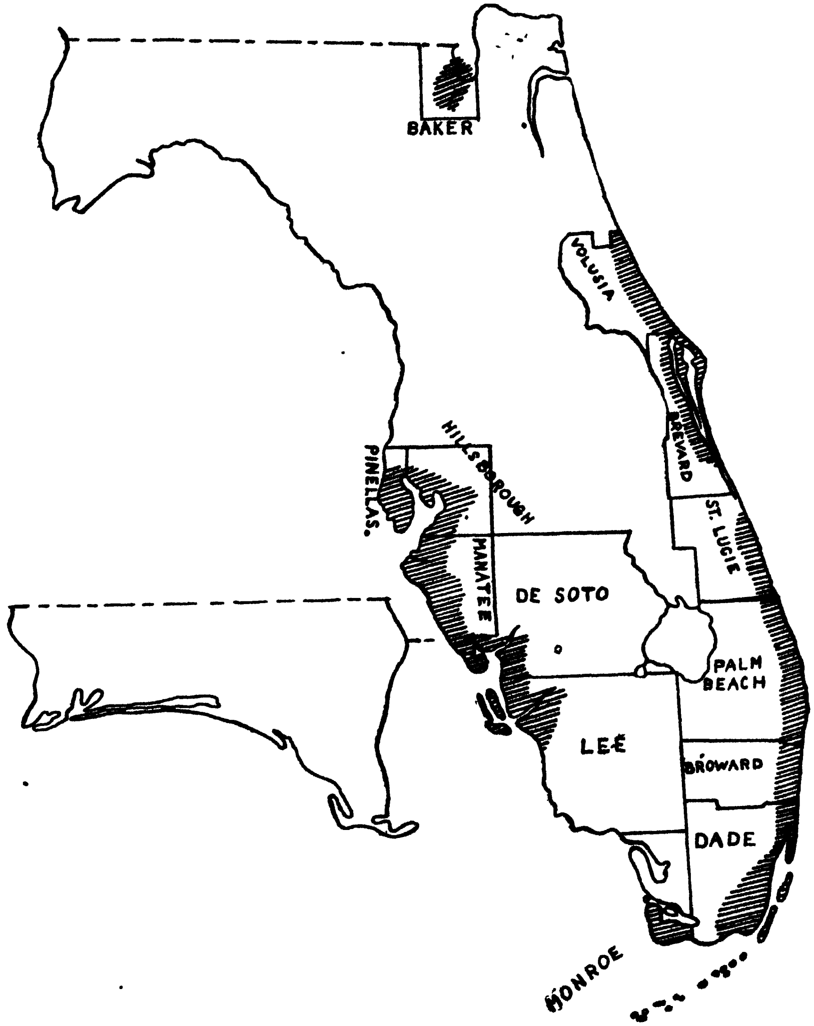

Fig. 8. Map of Florida showing areas at present known to be infested by the sweet potato weevil.

HOST PLANTS

The sweet potato plant is a close relative of the morning glory and it is therefore not surprising that the investigations of the past few months have shown that the insect breeds readily in the seaside morning glory *(Ipomoea pes-caprae)*, a small blue-flowered morning glory *(I. trifida)* and the moon-flower *(Calonyction aculeatum)*. In Mississippi it has also been found breeding in a closely related plant, *Ipomoea littoralis*. The seaside morning glory is of common occurrence along all of the sandy sea beaches of Florida, while the moon-flower occurs both along the coast and along lakes, canals, etc., in the interior.

This fact to some extent complicates the problems of control and eradication, for the occurrence of morning glory plants in or near infested fields must always be taken into consideration and dealt with as circumstances may require. For the same reason, all quarantines of the Plant Board applying to sweet potato tubers and plants apply also to morning glory roots and plants.

PLAN OF CAMPAIGN

The campaign against the sweet potato weevil, as now being carried on by the Bureau of Entomology and the State Plant Board, consists of three essential parts: preventing further spread of the weevil from areas already infested, control and eventual eradication of the weevil in the isolated infested area in Baker County and inspection of the plantings of growers who distribute sweet potato plants.

Preventing further spread of the weevil is accomplished mainly through the quarantine rules of the Plant Board, which prohibit tubers being shipped out of infested areas without first being fumigated, and the total prohibition of sweet potato plant shipments from infested localities.

In Baker County efforts are being made to personally instruct all farmers regarding the weevil and the measures by which damage from the insect can be reduced. The measures advocated at present consist of field rotation in planting, use of weevil-free plants, elimination of "hold-over" plantings, destruction of morning glory vines as far as practicable, thoroughness in harvesting, fumigation of harvested tubers, destruction of badly infested tubers, prevention of weevil damage in storage, destruction of volunteer plants in spring and avoidance of extremely early planting. It is hoped by these means to so greatly reduce the pest in Baker County that eventually eradication may be reached. In the meantime production of sweet potatoes in the infested area is being continued. The Baker County work is in reality an experiment upon a rather large scale to determine whether the insect can be eradicated and the production of sweet potatoes continued at the same time. The outcome of this experiment will doubtless determine whether eradication of the pest throughout the South generally should be undertaken.

Inspection of plantings in which sweet potato plants are grown for market has not been mandatory upon the plant growers and dealers but they have been quick to see the many advantages of furnishing weevil-free plants to their customers. During 1917, six growers applied for inspection and received certificates. During the spring of 1918 there were very few extensive plant growers in the State who did not request inspection. During this period 325 plantings were inspected, of which number 105 plantings were certified. Thirteen plantings were refused certification on account of the weevil being present in the plant beds or occurring in dangerous proximity thereto. Certificate tags to the number of 56,085 were issued for accompanying shipments of sweet potato plants. The sweet potato plant business of Florida is an important industry. The plant growers not only furnish many millions of plants to Florida farmers, but ship many millions more to states north of us where Florida-grown sweet potato plants are much in demand for the production of early crops. Sixty-six of the certified plant growers, during the season of 1918, made aggregate shipments of 34,940,200 sweet potato plants to customers in other states and, during the same season, sold 8,468,590 plants to Florida customers. The sweet potato plant business brings into Florida each year a sum of between $75,000.00 and $100,000.00. The continued shipment of plants into other states is entirely dependent upon continued close inspection, and certification, of the Florida plantings. In connection with these inspections every assistance possible was given the plant growers in keeping their plantings free from other destructive insects and from injurious sweet potato diseases.

The funds available to the Plant Board for this important work have been, unfortunately, very limited and the work could not have been carried on to the extent it has had it not been for the assistance rendered by the U. S. Department of Agriculture.

SERIOUSNESS OF SITUATION

Inasmuch as the sweet potato weevil threatens to destroy the sweet potato growing industry of Florida, as well as the important industry of supplying many millions of sweet potato plants to the growers of other states, the campaign against this insect should be waged vigorously and upon a scale sufficiently large to permit of rapid progress being made. The resources available for this work thus far have permitted of little more than the quarantine and inspection work to prevent further spread. It has not been possible to take up control and eradication of the pest in but one of the thirteen Florida counties in which it occurs. The sweet potato crop is one of the most important in Florida, particularly from the standpoint of the average farmer, and money cannot be expended to better advantage than in controlling, subduing and eradicating the weevil. Your Plant Commissioner urges that the great importance of this matter be brought prominently to the attention of His Excellency, the Governor, and to members of the Legislature.

BANANA ROOT BORER

Section 5 of the Plant Act requires the Plant Board to "list the insect pests and diseases of which it shall find that the introduction into, or the dissemination within, this State should be prevented."

The Board, at its meeting on February 14, 1916, having knowledge of the occurrence of a destructive banana pest in the West Indies, known as the banana root borer*, by resolution, declared this insect and all plants infested with it to be public nuisances, though the insect was not at that time known to occur within the State.

In December, 1917, a gentleman owning a banana planting near Larkins, Dade County, noticed severe injury to his plants and, finding an insect in the stems, took specimens of it to the Plant Introduction Gardens at Miami. Here it was examined by Mr. G. F. Moznette and by him sent to the Federal Horticultural Board at Washington. Mr. E. R. Sasscer, Entomological Inspector for the Horticultural Board on January 5, 1918, wrote the Plant Commissioner that the specimens had been identified as being the banana root borer.

Steps were immediately taken to determine the extent of the

**Cosmopolites sordidus.*

infested area and between January 5th and 19th inspection was made by Plant Board inspectors of 34 banana plantings, comprising 10,129 plants, in and around Larkins. Ten properties, containing 977 plants, were found infested, the actual number of infested plants being 367. The owners of these were only too ready to co-operate in eradicating the pest and the eradication work was immediately commenced. This consisted of uprooting and burning all banana plants in the infested properties, the plants being burned with the aid of large quantities of wood and oil. As it was realized that some of the insects would remain in the ground and others escape in the course of destroying the infested plants, a plan for trapping any such was devised. This consisted, at first, of planting young, healthy banana plants in the properties following destruction of the infested plants. It was found, however, that the young plants were not very attractive to the adult weevils, and as a result of observations by Mr. Paul M. Hoenshel, Assistant District Inspector, sections of banana stems were tried. Non-infested stems were cut into sections about a foot long and then split lengthwise and these laid on the ground with the flat surface downward. These were examined by the inspectors weekly and weevils found on or in them were collected and killed. The traps themselves were replaced with new ones at intervals of two weeks to prevent the possibility of any weevils maturing in them. This trapping was continued as long as weevils were being captured.

Inquiry into the history of the infested plantings at Larkins showed that the fields had been planted exclusively with plants purchased from a north Florida nursery in the spring of 1914, and that the latter nursery had, in turn, secured the plants from a south Florida nursery. Inspections of the banana plants in the latter nursery were made as soon (February, 1918) as this information was brought to light, but no specimens of the root borer were found until March 18, 1918. As soon as this discovery was made the owners of the nursery exerted every effort to assist us in eradicating the pest from their premises by proceeding at once to destroy all banana plants under direction of Plant Board inspectors. Traps to catch any weevils escaping the general cleaning-up process are at present in use in this property. A list of all parties to whom this nursery shipped banana plants during the past four years has also been obtained and investigations will be made to determine whether any of the plantings made from these are infested.

The investigations have recently brought to light an area of infestation by this insect in Manatee County and at the expiration of this report, April 30, 1918, the extent of this infested area is as yet undetermined. (See Supplemental Report, p. 95.)

It is of the utmost importance that every occurrence of this insect in Florida be located and the pest completely eradicated, particularly as the insect also attacks sugar cane and it is not impossible that its future presence in the State might seriously interfere with the development of a large sugar and syrup producing industry.

THE BLACK FLY

In our last report mention was made of the occurrence of the black fly, or "spiny citrus whitefly" in The Bahamas, Jamaica and Cuba and of the very destructive nature of this pest as determined by our Dr. J. H. Montgomery on his trip of investigation to Nassau in May, 1916.

During the past two years the danger of this insect being introduced into Florida has steadily increased although, fortunately, our Port and Railway Inspection Department, operating under the provisions of Rule 26, adopted by the Plant Board June 5, 1916, and amended November 12, 1917, has apparently been successful in thus far intercepting or preventing entry of all infested shipments and the insect is not yet known to have become established in the State.

The black fly must be regarded as a pest as much to be dreaded as citrus canker and there can be little doubt but what, if it becomes established in Florida, large sums of money will have to be expended in its eradication. It does not, however, confine its attacks to citrus trees but is also an enemy of the avocado, guava, pomegranate, papaya, plantain and other fruits.

Because of the heavy commerce between Florida and Cuba the black fly situation in the latter country is of great importance. Havana is less than one day's journey by boat from Key West and but two days' journey from Port Tampa.

THE SITUATION IN CUBA

Our first knowledge of the black fly occurring in Cuba was contained in a letter from Prof. John R. Johnston, Chief of the Comision de Sanidad Vegetal at Havana, dated May 31, 1916, sent in reply to our inquiry, advising that the insect had been found near Guantanamo in August, 1915, and that a subsequent survey had shown the infested area to be about two miles in diameter, in which citrus, mango, coffee and guava were affected. Efforts were made by the Cuban Government to eradicate this outbreak but local disturbances of a revolutionary nature later made necessary the abandonment of the work.

In December, 1916, the insect was found in the Vedado, a suburb of Havana, and by the following spring had infested many other suburbs of Havana and appeared at Hoyo Colorado, a point in Havana Province about 60 miles distant from Havana.

In August, 1917, Mr. Harold Morrison, of the Federal Horticultural Board, found the insect at both ends of the Panama Canal Zone.

In October, 1917, your Plant Commissioner, acting under instructions of the Plant Board, proceeded to Havana for the purpose of securing more information regarding the black fly, urging greater activity in Cuba towards subduing the pest and arranging for such co-operation with the Cuban Government as would tend to reduce the chances of the black fly being brought to Florida in shipments or by travelers. The writer held conferences with Professor Johnston and his immediate superior, Dr. Eugenio Agramonte, Secretary of Agriculture, Commerce and Labor, under direction of whose department the fight against the black fly was being carried on. The writer found the black fly to be fully as serious as previous reports had indicated and soon became convinced that the establishment of this pest in Florida would be little short of a calamity. A careful study was also made of the transporation system of Havana and vicinity and its bearing upon the possibility of black flies being transported to Florida in cars or vessels.

On the writer's return to Florida he submitted to the Plant Board a rather full report on his findings and the Board, on November 12, 1917, made broad amendments to its Rule 26 for the purpose of still further safeguarding the State against this pest and, at the same time, specifying the procedure to be followed if, at some future time, the insect should be found in Florida. This rule will be found in Circular 30 of the Plant Board. Under this rule the importation into Florida of all nursery stock, plants, foliage, etc., from black fly infested countries is prohibited and all fruits and vegetables arriving from such countries as well as the baggage of all passengers, undergo a rigid inspection at the ports of entry by inspectors of the Plant Board.

In November, 1917, the Cuban Congress, at the direct request of President Menocal, appropriated $50,000.00 for the fight against the black fly. Under this appropriation and under authority of the decrees issued by the President, the Office of Plant Sanitation waged an active campaign against the pest in Havana during the winter and spring months following. In this work the advice and assistance of your Plant Commissioner and his assistants was requested and, accordingly, General Inspector Frank Stirling spent January 5 to 19, 1918, in Havana, acting in an advisory capacity and giving Professor Johnston suggestions based upon the Plant Board's experience in dealing with the citrus canker situation in Florida, the two problems being not unlike in many phases of the inspection and field work. At this time the Office of Plant Sanitation expressed a desire to avail itself of the services of two experienced inspectors from Florida and accordingly Assistant Nursery Inspector L. Russell Warner and Assistant District Inspector H. D. Bollinger were granted leaves of absence by the Plant Board and entered the employ of the Office of Plant Sanitation at Havana in February, 1918. At the present time both are still there, Mr. Bollinger assisting in the organization and management of the field inspection work and Mr. Warner in the nursery inspection work.

From November, 1917, to April, 1918, a vigorous campaign was waged against the black fly in Havana and its suburbs by the Office of Plant Sanitation, and as a result of the spraying and pruning of infested trees the insect was very materially reduced in numbers. To a considerable extent, also, host plants of the fly were removed from the railroad rights of way in the infested district, thus reducing the chances of adult black flies being transported to Florida in freight cars carried on the ferry to Key West.

In the meantime, however, no steps of consequence were taken to control the infestation at Guantanamo. The black fly appeared at additional points in Havana Province, and was found at twenty-three places in Santiago de Cuba Province, including the city of Santiago de Cuba. The infestation in the latter city is particularly severe.

On the whole, therefore, it cannot be said that the situation is any less threatening, so far as the danger of introducing the pest into Florida is concerned, than it was a year ago.

The black fly has on two occasions been discovered by Plant Board inspectors in material arriving from Cuba. On one occasion a passenger from Havana was found, on her arrival at Key West, to have a cluster of grapefruit, leaves and twigs in which infested leaves were found. In the other case a commercial shipment arriving at Port Tampa was found to contain material infested with the black fly. These instances serve to show the actual danger existing and it is safe to conclude that, but for the vigilance of Plant Board inspectors, this dread pest would already be established in Florida.

BOLL WEEVIL QUARANTINE

In our last report we called attention to the well-known fact that the boll weevil has two methods of dissemination, one by natural flight or migration and the other by transportation in cotton seed, hulls, Spanish moss, etc. Migration or spread by flight cannot be prevented and each year results in the insect invading new territory. Distribution by means of cotton seed, moss and certain other articles *can* be prevented by suitable quarantine measures.

In the fall of 1915 the eastern limit of the boll weevil infested area in Florida passed through Hamilton, Madison and Taylor Counties. During the summer and autumn of 1916, the insect, by means of its annual migratory flight, infested additional territory to the east and south, the eastern limit of the infested territory in November, 1916, running through Nassau, Duval, Clay, Bradford and Levy Counties. Again in the summer and fall of 1917, the weevil extended its range, the southern limit of infestation in December, 1917, passing through Volusia, Lake, Sumter and Citrus Counties.

The Plant Commissioner's staff has continued to enforce the provisions of Rule 18 of the Plant Board, which prohibits the shipment, from weevil-infested territory, of cotton seed, cotton seed hulls, Spanish moss, corn in shuck, and certain other materials, to weevil-free areas except at such seasons and under such conditions as permit of the shipments being made without danger of transporting living boll weevils. Provision has been made for the shipment of cotton seed for planting purposes, from the weevil area to the weevil-free area, after such seed has been fumigated by the Entomological Department of the Board. During the season of 1917-18, the Entomologist fumigated a total of 2006 bushels of cotton seed which were sent to south Florida for planting.

These precautions have undoubtedly prevented the weevil establishing itself in many localities ahead of the advancing line of migrating weevils, and such localities have enjoyed immunity from the pest for from one to three seasons longer than would have been the case had such quarantine measures not been in effect.

PINK BOLLWORM QUARANTINE

The pink bollworm, a destructive cotton insect, was apparently introduced into Mexico in 1911 in a shipment of cotton seed from Egypt to Monterey and was introduced into the Laguna cotton growing region of Mexico the following year in shipments of seed from the infested Monterey section. However, these facts did not become known to the authorities in the United States until in November, 1916.

In the meantime, during 1916, shipments of Mexican cotton seed to the amount of more than 500 carloads had been sent to cotton oil mills in Texas. As soon as the presence of the pink bollworm in Mexico became known the Federal Horticultural Board, U. S. Department of Agriculture, prohibited the further importation of Mexican seed, expedited the crushing of all Mexican seed at the Texas mills and began active inspection of cotton fields in the vicinity of all the mills which had received seed from Mexico. These inspections brought to light two localities in Texas infested with the pink bollworm. One of these was found at Hearne, in September, and the other at Beaumont in October, 1917. All cotton plants in the infested fields and those adjoining were uprooted and burned and all vestiges of cotton destroyed. Over seven thousand acres were treated in this way.

Later in 1917 infested areas were found on Galveston Bay and Trinity Bay, south and southeast of Houston, Texas. The presence of the insect in this area is attributed to the fact that in August, 1915, several thousand bales of Mexican cotton were on the docks at Galveston when the severe storm of that month occurred and carried many of these bales to the mainland, broke them open and scattered the contents over many thousands of acres along Galveston and Trinity Bays. This cotton undoubtedly contained much seed which in turn contained larvae of the pink bollworm.

A special act was passed by the Texas Legislature providing for the destruction of all cotton in infested areas and prohibiting the planting of cotton in such areas for a period of three years. In co-operation with the Federal Horticultural Board, the Texas State Department of Agriculture proceeded to destroy all cotton in the infested area south of Houston. This area was found to be about 50 miles wide by 150 miles long and covered all or parts of seven counties. The actual cotton in this area in 1917 was 3,829 acres.

Realizing that the infestation in south Texas was severe and widespread and knowing that cotton and seed had been shipped out of the infested Texas area in 1915 and 1916, thus giving rise to the possibility of centers of infestation as yet undiscovered, the Plant Board, on December 10, 1917, adopted its Rule 37, prohibiting the importation into Florida, from all states west of the Mississippi River, of all cotton lint, linters, waste, waste cotton and similar products.

The menace to the cotton industry was considered so serious that a conference of the quarantine officials of the cotton growing states was held at Houston, Texas, on January 18, 19, 1918. This conference was attended by your Plant Commissioner. acting under instructions from your Board, and a full report thereon submitted to the Plant Board on January 31, 1918.

The destructiveness of the pink bollworm to cotton under conditions existing in the Southern States may be gathered from the fact that in fifty pounds of mature bolls gathered at Smith Point, Texas, 1300 living pink bollworms were found. In this vicinity, in the fall of 1917, the insect destroyed forty per cent of the cotton bolls.*

Whereas the boll weevil flourishes and reaches its maximum of destructiveness in damp or rainy weather, the pink bollworm increases most rapidly in dry seasons and therefore reaches maximum destructiveness under those conditions which are unfavorable to the boll weevil. There can be no doubt but what the presence of both these destructive cotton pests in Florida would make the production of cotton impossible. The quarantine measures which the State Plant Board now has in effect for the purpose of excluding the pink bollworm should by all means be continued, particularly as co-operation of cotton planters, in the infested area of southern Texas, with the State and Federal officials, has not been unanimous and it is not yet certain by any means that the Texas outbreaks will be eradicated.

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*A comprehensive account of the pink bollworm, by W. D. Hunter, of the Federal Horticultural Board, was published in the April, 1918, issue of the Plant Board's Quarterly Bulletin.

OTHER QUARANTINES

The Plant Commissioner has continued to enforce the various quarantine measures adopted by the Board for the purpose of preventing the introduction into Florida of the avocado weevil, banana wilt disease, brown rot of lemons and oranges, gypsy and brown-tail moths, citrus knot, cocoanut bud-rot, Mediterranean fruit fly, Mexican orange maggot, pineapple black weevil, West Indian sweet potato weevil, mango seed weevil and Argentine ant. In addition the inspectors in the Port and Railway work are ever on the alert for new or unknown insect pests which may be contained in importations.

DEPARTMENT OF ENTOMOLOGY

During the biennium the work of this Department has progressed very satisfactorily under the direction of Dr. E. W. Berger, Entomologist.

One assistant entomologist has been provided for by the Board. At the time of our last report this position was held by Mr. C. E. Wilson. Later he was succeeded by Mr. F. F. Bibby. After both Messrs. Wilson and Bibby entered the military service of the United States, Mr. Geo. B. Merrill was detailed from the Port and Railway Inspection Department to assist the Entomologist.

The amount of work accomplished in this Department, with a staff of but two men, is most creditable. The Department has been, and is, prosecuting six important lines of work, namely, growth and distribution of the red whitefly fungus for control of the whitefly, distribution of Australian lady-bird beetles for control of the cottony cushion-scale, investigations in the control of the camphor thrips, identification of insects in connection with the port and railway and nursery inspections and for growers, the giving of advice, through correspondence or personal visits, for the control of insect outbreaks and the keeping of records and specimens in connection with the distribution and prevalence of injurious insects within the State.

RED WHITEFLY FUNGUS

This fungus disease attacks the larvae of the citrus whitefly, destroying the latter. Its value is well-known to Florida citrus growers. Formerly the fungus was introduced in groves by means of fungus-bearing leaves taken from groves where this beneficial disease occurred. As this practice also involved the danger of disseminating injurious diseases, such as scaly bark, citrus canker, etc., the Plant Board in 1915 began advocating the use of pure cultures of the fungus, prepared in the Entomologist's laboratory, in lieu of fungus-covered leaves. The demand for these cultures, which are sold by the Plant Board at a price barely sufficient to cover the cost of the material used in their preparation, has increased each year and has been greater than the Department could supply with the facilities available.

During the fiscal year ending April 30, 1917, 328 of these cultures, sufficient to inoculate the whitefly in 328 acres of grove, were sold. During the fiscal year ending April 30, 1918, 757 of the cultures were sold.

Experiments have also been made by the Entomologist looking to securing a higher percentage of "fruiting," or usable cultures, through the control of temperature and other conditions. Considerable progress has been made.

Another whitefly fungus, known as the yellow Aschersonia, is useful in controlling the cloudy-winged whitefly and can also be prepared in the form of laboratory cultures. A considerable number of cultures of this fungus were also prepared by the Entomologist and furnished to growers in sections where the cloudy-winged whitefly is prevalent.

AUSTRALIAN LADY-BIRD BEETLES

The Vedalia, or Australian lady-bird beetle, is most efficient in controlling the cottony cushion-scale. From time to time the latter pest is found in new localities, making immediate introduction of the lady-bird bettle imperative. In localities infested with cottony cushion-scale the latter, through activities of the lady-bird beetles, often become so reduced in numbers that the beetles also become extinct, or nearly so, and in this case re-introduction of the lady-bird beetles becomes necessary.

The Entomological Department has continued its work of collecting colonies of the Vedalia and distributing them to growers. A nominal charge of $1.00 per colony of 12 to 15 beetles is made to cover expense of collection and distribution. Prior to the Plant Board engaging in this work, these bettles were not infrequently sold by private collectors at from $6.00 to $10.00 per dozen.

After considerable experimentation the Entomologist and his assistants have found that, within certain limits, the lady-bird beetles can be reared in the laboratory by feeding them upon cottony cushion-scale. To accomplish this large supplies of the scale must be collected and kept in cold storage over considerable periods in order that a constant supply of food may be available for the Vedalia larvae. It has also been found that, in the temporary absence of scale, the young beetles can themselves be placed in cold storage and their development arrested pending the arrival of their next consignment of food. By following this method, supplemented by collections of lady-bird beetles by representatives of the Department and by assistant nursery inspectors, the Department has been able to meet practically all requests for the Vedalia.

During the fiscal year ending April 30, 1917, 72 colonies were furnished to Florida growers and 100 colonies to the Cottony Cushion-scale Commission of New Orleans, La., for control of a severe outbreak of the cottony cushion-scale in that city.

During the second fiscal year, 193 colonies, comprising 2400 lady-bird beetles, were distributed in Florida.

CAMPHOR THRIPS

The experiments, intended to provide an efficient treatment to free young camphor trees from the camphor thrips, mentioned in our last biennial report, were continued. Camphor trees infested by the thrips, treated with various insecticides and planted in isolated localities, did not afterwards show infestation. However, the cold weather of February, 1917, severely injured many of these trees, making interpretation of the results, so far as effect of the insecticide on the trees was concerned, rather difficult. However, the Entomologist has been able, from the experience obtained, to develop a combined method of cutting back and treating of infested trees which renders them free from infestation. This method is now being used in camphor tree nurseries for treatment, under supervision of the Nursery Inspector, of infested trees prior to the latter being sold or shipped.

IDENTIFICATION OF INSECTS

Both the nursery inspectors and those engaged in the inspection of plant importations encounter many insects which cannot be identified except in the laboratory and by specialists. Such work falls to the lot of the Entomological Department and is of the utmost importance, for upon its accuracy depends in large degree the success of the Plant Board's nursery inspection and quarantine work. Farmers and fruit growers also submit many specimens, the identification of which is necessary in order that owners of infested groves or crops may be advised as to the proper measure for control.

During the first year of the biennial period 612 identifications were made. These insects were from 119 host plants and came from 128 different localities.

During the second year 2593 specimens of insects were received at the Department, all of which were identified with the exception of a few extremely rare or new species which were referred to other specialists.

OTHER WORK

In connection with the Plant Board's quarantine to restrict the spread of the cotton boll weevil, the Entomological Department has fumigated cotton seed for planting in weevil-free sections of the State. During the year ending April 30, 1917, 1662 bushels were thus treated and during the second year 2006 bushels.

A large number of letters requesting advice regarding the control of various injurious insects are answered by the Entomologist and in the case of severe outbreaks of such pests personal aid and instruction is not infrequently given.

The Department is also engaged in keeping records regarding the occurrence of insects in different parts of Florida, together with specimens, these records forming a valuable and important source of information in connection with many practical problems arising from time to time.

In view of the steady increase in the demands made upon this Department and the necessity of still further enlarging the facilities for supplying the red whitefly fungus and Australian lady-bird beetles, your Plant Commissioner recommends that an additional assistant be provided for the Entomologist at the earliest date possible.

DEPARTMENT OF PLANT PATHOLOGY

Our last report recounted the establishment, at Redland, Dade County, in co-operation with the South Dade County Fruit Growers' and Truckers' Association, of the "Tropical Laboratory" for the purpose of making careful investigations of citrus canker and methods for its cure or eradication. Work was continued at the laboratory under the direction of Dr. R. A. Jehle, Assistant Plant Pathologist of the Board, until November, 1917, at which time the laboratory was discontinued for reasons given below.

The most careful investigations of the character and nature of citrus canker, coupled with practical tests of various "remedies" or "cures" proposed by others, showed conclusively that there is no remedy for this disease other than prompt and complete destruction of the infected trees, coupled with rigid disinfecting and antiseptic measures.

Extensive experiments were made by Doctor Jehle to ascertain whether any non-citrus plants might be susceptible to citrus canker. Practically all cultivated and native trees and ornamental plants commonly found in south Florida were subjected to inoculation tests, this work being carried on in a well-screened, locked cage specially built for the citrus canker experiments.* Only one non-citrus plant, the so-called "wild lime," *Zanthoxylum fagara,* was found susceptible to the disease. Pinprick inoculations in leaves of the wild lime resulted in typical citrus canker spots being produced and bacteria from these spots, in turn, produced typical citrus canker on grapefruit leaves. However, the discovery of one non-citrus host plant of the disease did not add any serious complication to the problem of eradication. Upon this discovery being made, inspections by the field force were extended to include all wild limes, but in no case has citrus canker been found upon the wild lime growing at large.

Very extensive experiments were made in the testing of various disinfectants on the citrus canker organism. The object of these was two-fold: first, to find a cheaper and better disinfectant for sterilization of clothing, tools, etc., and, secondly, to prevent serious interruption of the canker eradication work in case of any shortage, during the war, of the standard material, corrosive sublimate, generally used for this purpose. These experiments showed that a number of substitutes could be successfully used, but that under ordinary conditions, all things considered, the use of a corrosive sublimate solution, 1:1000, was the most effective and economical.

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*An illustration of this cage will be found in the Quarterly Bulletin, Vol. I, No. 2, pp. 25 and 28.

Much of Doctor Jehle's time was devoted to testing various treatments and supposed "cures" for citrus canker, suggested or proposed by various parties. Without exception, all such methods or preparations were found worthless for the purpose intended.

Not the least in importance of the work done at the laboratory was the making of laboratory examinations and tests of canker infections found by the inspectors in their field work, particularly in Dade County. In some few instances the identity of doubtful infections could not be clearly established until after such tests.

Under Doctor Jehle's authorship, an article on "Characteristics of Citrus Canker and of the Causal Organism" was published in the Quarterly Bulletin for January, 1917, and another entitled "Effect of Disinfectants upon *Bacterium citri*" in the Quarterly Bulletin for January, 1918.

In October, 1917, it was decided to discontinue the work at the laboratory. This conclusion was reached on several considerations. In the first place it was evident that as much information as possible, bearing upon the practical work of eradicating citrus canker, had been secured. Secondly, as the disease was apparently almost eradicated in south Dade County, it was deemed unwise to continue keeping canker-infected trees in existence, even in a screened cage. Finally, it was felt that the funds required to maintain the laboratory could henceforth be used to greater advantage in actual inspection and eradication work. The water works, gas plant and two sterilizers at the laboratory were transferred to the South Dade County Fruit Growers' and Truckers' Association, the Association desiring to keep sufficient permanent equipment so that local investigations of various diseases could be made as occasion required. The remaining laboratory equipment was shipped to Gainesville where it is now in storage at the University.

In October, 1917, Doctor Jehle accepted a position with the Bureau of Plant Industry, after having rendered faithful service to the Plant Board during the continuation of the laboratory investigations.

Since the discontinuance of the laboratory no plant pathological work has been conducted by the Plant Board. During this period, however, the Plant Commissioner and his staff have had the benefit of the advice and counsel of Prof. P. H. Rolfs, Director, and Prof. H. E. Stevens, Plant Pathologist of the University of Florida Experiment Station.

PUBLICATIONS

The State Plant Board issues three publications, the "Circulars," The Quarterly Bulletin and "Port and Railway Inspection Notices."

CIRCULARS

The Circulars of the Plant Board, published in relatively small editions, give publicity, as required by law, to all rules, regulations and public notices adopted or promulgated by the Board. They are issued as necessary, and the frequency of their issue is dependent entirely upon the necessity of the Board making changes in its rules as the result of experience or the occurrence of unusual conditions.

Since our last report, Circulars Nos. 18 to 30, inclusive, have been issued. Circular 30, issued July 31, 1918, contains all Rules and Public Notices of the Board as now in effect, together with the Florida Plant Act of 1915.

THE QUARTERLY BULLETIN

Publication of The Quarterly Bulletin was commenced in October, 1916, a copy of Vol. I, No. 1, having been submitted with our last report. The Quarterly Bulletin has been issued regularly during the biennium. It has been the object of the editors to include in The Quarterly Bulletin only such articles as possess a permanent value and can be used for distribution for many years to come. During the biennium articles by competent authorities have been published upon fumigating nursery stock, citrus canker, the pineapple black weevil, sweet potato weevil, Mediterranean fruit fly, Florida scale-insects, avocado weevil, citrus blast, the pink bollworm and diseases of the sweet potato, as well as regular quarterly reports on the citrus canker eradication work, port and railway inspection and parcel post inspection services.

The Quarterly Bulletin is the only official publication in Florida devoted exclusively to the prevention, control and eradication of injurious insects and plant diseases and has repeatedly proven its value to growers and farmers. Your Plant Commissioner recommends that facilities be provided for its continued publication and enlargement during the next two years.

PORT AND RAILWAY CIRCULARS

These circulars contain such sections of the Plant Act and Rules of the Board as are of interest and importance to common carriers, steamship companies and importers of plant products. Such explanatory matter is included as will make clear the application of various quarantine orders, etc., and the Board rules are arranged according to subject. Editions are limited to the number of copies required for distribution to common carriers and their agents and such importers as are affected by the Board's rules.

Timely articles on various subjects have been furnished the agricultural press of the State from time to time.

EMPLOYEES

Because of its co-operation with the Bureau of Plant Industry and Federal Horticultural Board, the Plant Board must of necessity have a large number of employees. It has also, with a few exceptions, had to train its employees for the work which they were to do. The maximum number of employees was reached in August and September, 1916, when the fight on citrus canker was at its most critical stage. During those months 418 employees were on the rolls. Since that time the force has gradually been reduced, there being 230 salaried employees on April 30, 1918.

Efficiency and fitness have been the sole qualifications for employment by the Board. In no case have positions been filled for personal or political reasons, and the employees now upon the force are, without exception, experienced, efficient and thoroughly devoted to the interests of the public.

In reducing its force, the Plant Board has found it advisable to retain in its service the most efficient employees, granting them advances in salary commensurate with their value and ability.

VACATIONS

Vacations are granted to employees of the Board only upon special Board action in each case. The amount of vacation time granted, from the creation of the Plant Board on May 4, 1915, to April 30, 1918, has averaged 2.16 days per employee per year of service.

PERSONNEL

In the Plant Comissioner's office complete records are kept concerning each employee, his term of service, efficiency, salary, etc. Space prevents publication of the names and terms of service of all employees, hence we give here only the names of the employees in service at the end of the fiscal year April 30, 1918:

EMPLOYEES, APRIL 30, 1918:

Mack, Bryan (Tallahassee)	*Secretary*
Kellum, J. G. (Tallahassee)	*Auditor*

PLANT COMMISSIONER'S OFFICE

Newell, Wilmon	*Plant Commissioner*
Goodwin, J. C.	*Chief Clerk*
Stone, O. T.	*Office Assistant*
Cornwell, Miss Madge E.	*Stenographer*
Carlisle, Mrs. Kathleen R.	*Stenographer*
Murrill, Miss Ethel R.	*Stenographer*
Carey, Mrs. Bertha A.	*Stenographer*
Means, Miss Eva C.	*Filing Clerk*
Lloyd, Henry (col.)	*Janitor*

DEPARTMENT OF CITRUS CANKER ERADICATION

Stirling, Frank	*General Inspector*
Montgomery, J. H.	*General Grove Supervisor*
Holton, John C.	*Assistant General Inspector*
Hecker, Mrs. Lottie A.	*Stenographer*

District Inspectors

Bass, Milledge M.
Campbell, M. G.
Daniel, L. A.
Gist, J. V.
Heck, Joy
Mears, John M.
Nieland, F. C.
Schlobig, John
Smith, Cleve F.
Swanson, A. L.
Wartmann, H. A.

Assistant District Inspectors

Artis, Harvey C.
Benedict, Wm. L.
Carter, H. G.
Dunaway, Wilbur E.
Gaston, B. O.
Goldberg, E. R.
Hoenshel, Paul M.
Kerr, James
Potter, E. R.
Tedder, Geo. E.

Foremen

Adams, Arthur
Adams, B. F.
Bateman, R. G.
Browne, C. E.
Burden, G. F.
Cash, R. P.
Cellon, F. M.
Culley, P. E.
Dillingham, H. J.
Eikenberry, H. D.
Eiland, John
Flowers, B. L.
Ford, Arthur E.
Gibson, P. B.
Gossman, Harvey L.
Gwynn, E. L.
Haywood, F. E.
Henderson, R. C.
Henderson, Wm. H.
Ingram, John W.
Johnson, August P.
Kelley, Emory L.
Laing, James D.
Liles, Edd.
Linder, Ross W.
Ludlam, Jos. W.
McClanahan, S. L.
Mahan, Wm. D.
Mendel, James C.
Millington, Wm. V.
Nutting, Chas. T.
O'Shields, Odom S.
Raab, Albert G.
Reynolds, David N.
Reynolds, Roscoe
Richmond, Leon C.
Schumacher, Henry F.
Sheffield, C. P.
Stephens, Wm. L.
Strain, John G.
Thomas, Willious H.
Wade, Geo. W.
Witt, Henry S.

Inspectors

Alexander, David N.
Alexander, Guy T.
Baillie, Wm. J.
Baker, J. Otis
Baker, L. J.
Bass, Clarence A.
Beaty, Alwyn L.
Beville, Ulmont U.
Blackburn, Grover C.
Bosse, Rufus F.
Boyett, Marshal M.
Brown, Chas. M.
Brown, Merle R.
Brown, Ollie D.
Buff, Wm. D.
Butler, Lee
Carter, D. T.
Cash, R. A.
Clinger, John A.
Conner, Daniel S.
Curry, W. R.
Daughtrey, J. A.
Douglass, Elmer E.
Dukes, James R.
Dyson, Zeblon V.
Ellis, Thos. R.
Fish, Robert E.
Fitch, Samuel H.
Freeman, Jesse W.
Frierson, Ed.
Frierson, Hill H.
Fry, Benjamin B.
Fuller, Richard M.
Green, Joseph T.
Hall, Clayton E.
Hammell, David L.
Hansen, Hans W. A.
Harden, John C.
Hawkins, H. S.
Hayman, Jas. T.
Henderson, J. Harvey
Hoiland, Edward Alton
Holland, James S.
Holland, Jos. W.
Hooker, A. S.
Irwin, Harry M.
Janes, George
Jenness, Walter E.
Kersey, Walter L.
Kinyoun, Gray
Lahrman, Walter O.
Lamb, Kirkland S.
Lazonby, J. Lionel
Lee, Dock
Lee, Russell E.
LeRoy, Merton
Little, Arnaud R.
Lott, W. V.
McAllister, A. O.
McLendon, Albert S.
McLendon, John A.
McLendon, Henry L.
Mahan, Chas. R.
Marsh, James F.
Marshall, Galen G.
Melendy, B. E.
Merrill, Wm. H.
Milledge, Stanley
Morgan, Jas. R.
Nixon, Roy R.
Noxtine, H. A.
Oakley, Archie R.
Oliphant, Ross G.
O'Quinn, D. Henderson
Parham, Harry C.
Park, Bradley
Parker, Frank R.
Perkin, Howard W.
Pinelli, John
Poucher, A.
Pryor, T. J.
Putnal, Bonnie W.
Robertson, Paul F.
Robinson, Vernon K.
Rodgers, Wm. B.
Ross, James B.
Royal, John W.
Rudesill, Dick
Scudder, Hamilton F.
Sealey, John
Shelton, J. L.
Shriner, Ike M.
Smith, Herman D.
Smith, Lonnie S.
Spiller, Wm. A.
Stephens, Robert C.
Stevenson, Elbert M.
Stevenson, Geo. A.
Stevenson, Richard D.
Stokes, Clifford
Strong, C. E.
Taylor, Jesse F.
Thomas, Paul
Thompson, Roy
Thomson, James
Thurmond, J. W.
Ulmer, Henry L.
Ulmer, Julius E.
Ulmer, Robert L.
Wahlberg, Emil
Walker, Shirley B.
Wallace, D. W.
Wells, Benjamin B.
Wilson, James H.
Wilson, Jos. H.

DEPARTMENT OF NURSERY INSPECTION

O'Byrne, F. M.	*Nursery Inspector*
Baker, Geo. H.	*Assistant Nursery Inspector*
Baker, Thos. J.	*Assistant Nursery Inspector*
Chaffin, J.	*Assistant Nursery Inspector*
Hall, James E. B.	*Assistant Nursery Inspector*
Knight, Robert A.	*Assistant Nursery Inspector*
Linger, Russell B.	*Assistant Nursery Inspector*
Mowry, Harold	*Assistant Nursery Inspector*
Nanney, W. C.	*Assistant Nursery Inspector*
Potter, Roscoe D.	*Assistant Nursery Inspector*
Swartsel, Howard B.	*Assistant Nursery Inspector*
Walker, Shirley B.	*Assistant Nursery Inspector*
Wartmann, H. A.	*Assistant Nursery Inspector*
Whittington, C. E.	*Assistant Nursery Inspector*
DaCosta, Miss Mary W.	*Stenographer*
McIlvaine, Miss Lucretia	*Stenographer*
Colson, Mrs. K. D.	*Stenographer*

Packing-house Inspectors*

Black, W. C.
Blackburn, G. W.
Bruyiere, J.
Carn, B. O.
Cartledge, E. V.
Cason, J. W.
Cobb, J. W.
Coile, J. G.
Collins, W. B.
Cox, S. C.
Dade, W. A.
DeLanoy, S. S.
Dowdell, Silas
Eastman, H. L.
Ellas, H. S.
Flint, J. H.
Flood, H. V.
Flowers, W. H.
Ford, George
Frese, J. A.
Gates, Josiah
Gillingham, H.
Hendrix, D. A.
Humbarger, John
Knowles, Austin
Layton, W. I.
Leisegang, Conrad
Liphard, F. C.
Little, F. D.
Luce, D. H.
McKnight, T. J.
McRee, J. N.
Millen, S. E.
Mulrennan, Joe
Newbank, Neil
Nighswanger, L. Z.
Oesterle, Chas.
Oliver, T. S.
Parker, Phil C.
Price, Jack
Pylant, S. Lee
Right, W. W.
Robertson, A. H.
Robles, J. H.
Rogers, O. H.
Roper, B. H.
Scorgie, L. A.
Sessions, E. R.
Shelton, J. S.
Smith, L. W.
Stoltz, F. W.
Thompson, J. N.
Thullbery, C. C.
Townsend, L. E.
Williams, Boyce
Wirt, T. E.
Young, A. I.

DEPARTMENT OF ENTOMOLOGY

Berger, E. W.	*Entomologist*
Merrill, Geo. B.	*Acting Assistant Entomologist*
Evans, Miss Ella M.	*Stenographer*

DEPARTMENT OF PORT AND RAILWAY INSPECTION
(Plant Commissioner in Charge)

Bragdon, K. E.	*Deputy Port and Railway Inspector*
Gehry, Emil L.	*Deputy Port and Railway Inspector*
Graham, Erwin M.	*Deputy Port and Railway Inspector*
Hull, W. N.	*Deputy Port and Railway Inspector*
Thompson, Troy	*Deputy Port and Railway Inspector*
Zeluff, U. C.	*Deputy Port and Railway Inspector*

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*"Packing-house inspectors" are employed to supervise the fumigating, dipping, scrubbing or other precautionary treatments prescribed for nursery stock packed by certain nurseries, such as those occurring in cottony cushion-scale areas, and are paid only for time actually employed. The wages of the packing-house inspectors are charged to the nurseries in which their work is performed. The Plant Board incurs no expense for their services.

SUPPLEMENTAL REPORT

May 1 to September 30, 1918

During this period the work of the Board has been continued with little interruption along the same lines as heretofore. Some decrease in the number of employees has taken place, due to entrance of men into the Army and Navy and also due to the attractive salaries available in other lines of work. Continued progress in the canker eradication work has also permitted a gradual decrease in the number of employees engaged in citrus inspection work.

Among the most striking developments during this period has been the discovery of additional infestations by the banana root-borer and an unprecedented outbreak of the semi-tropical army worm. More detailed reference is made to these below.

CITRUS CANKER ERADICATION

During this period, no infections were found in sections or localities not previously infected.

During May one infection was found in one of the hitherto infected properties and in June two new properties in previously infected centers showed infection.

During the balance of this period, July, August and September, no canker was found, although the inspection work was kept up to the maximum efficiency.

The work done, together with the results accomplished, are shown in the following table:

Month	Grove trees inspected	Nursery trees inspected	New properties infected	Properties declared no longer "danger centers"	Number inspectors employed
May	749,650	4,856,106	0	0	210
June	702,752	4,463,078	2	6	200
July	540,713	5,018,350	0	1	193
August	559,063	4,655,810	0	0	190
September	494,060	4,071,145	0	4	186
Total	3,046,238	23,064,489	2	11	

Grand Summary, Canker Eradication Work, to Sept. 30, 1918

Properties found infected May 1, 1914, to April 30, 1918	477	
Additional properties found infected between May 1 and Sept. 30, 1918	2	
Total properties infected to September 30, 1918		479
Properties declared no longer danger centers to April 30, 1918	426	
Declared no longer danger centers between May 1 and Sept. 30, 1918	11	
Total		437
Properties still classed as infected September 30, 1918		42

NURSERY INSPECTION

Regular inspections of the nurseries heretofore mentioned have been continued and 81 additional nurseries were located and inspected for the first time.

Tabulated Report of Inspections

Number of nurseries inspected from May 1, 1918, to Sept. 30, 1918	1572
Total number of inspections made from May 1, to Sept. 30, 1918	2319
Number of nurseries inspected for the first time, May 1 to Sept. 30, 1918	81

Certification Refusals

From May 1 to September 30, 1918, the total number of certification refusals, for the reasons indicated, was as follows:

Avocado scab	28
San Jose scale	17
California red scale	34
Camphor thrips	4
Whitefly and scale	621
Excessive citrus scab	0
Dictyospermum scale	1
Foot-rot of citrus	2
Red-banded thrips	0
Dieback of pecan	0
Other causes	55
Total	762

Quarantines

Quarantines were imposed as follows:

Canker in nursery	0
Nursery in canker zone or a contact property	56
Other causes	3
Total	59

Inspection Certificates Issued

From May 1 to September 30, 1918, the number of inspection certificates issued was as follows:

Kind of tag	Number of tags issued				
Regular tags	14,851	to	85	firms	and individuals
Package tags	223	to	20	"	"
Scaly-bark tags	345	to	7	"	"
Stock-dealers' tags	1,100	to	3	"	"
Florida permit-tags	7,189	to	43	"	"
Total	23,708	to	158	"	"

QUARANTINE DEPARTMENT

This Department, as originally established by the Board, was designated as the "Port and Railway Inspection Department." During the past two years, however, much work other than actual inspection at ports and railway centers has become necessary and as this work involves quarantines to a greater or less extent such work properly falls to the lot of this Department. For example, the discovery of the banana root-borer in the State and the necessity for its eradication, as well as the urgent necessity of restricting the further spread of the sweet potato weevil through quarantine and other measures, has added new duties to this Department. The Board therefore felt that the former name of the department did not adequately describe its functions and at its meeting at St. Augustine on May 10, 1918, changed the name to that of "Quarantine Department," at the same time electing Dr. J. H. Montgomery, formerly General Grove Supervisor in the canker eradication work, to the position of Quarantine Inspector and Chief of the Department. By the same action, assistant inspectors in this Department were designated as "Assistant Quarantine Inspectors."

Since the conclusion of our report of April 30, 1918, we have continued to strengthen and extend the work of the Quarantine Department. This has been made necessary largely because of certain activities on the part of the military and naval authorities, the exact nature of which it is not permissible to print in this report.

Interceptions

Although injurious insects and diseases are intercepted every day of the year by inspectors of the Quarantine Department, some of the interceptions are worthy of special attention. One such was the interception at Key West of a shipment of guavas from Cuba which were infested with the West Indian fruit-fly, a pest which, in Cuba, does great injury to many of the fruits which are grown on a commercial scale in Florida.

Two very recent interceptions have been made, the importance of which justifies mention, despite they were made since the end of the period (September 30th) covered by this supplemental report.

On October 10th Assistant Quarantine Inspector Paul M. Hoenshel at Jacksonville intercepted a shipment of sweet potatoes from Porto Rico which were infested with the sweet potato scarabee. The establishment of this insect in Florida would doubtless cause as much injury to the sweet potato industry as the sweet potato weevil, which is already present in parts of the State (see page 68).

On October 15th, Assistant Nursery Inspector Howard B. Swartsel, while inspecting a carload of birch hoops in Manatee County, which hoops had been shipped from Massachusetts, found several egg-masses of the Gypsy moth. The latter is one of the most destructive insect pests of fruit and forest trees in the United States, and in New England, where large sums have been spent in its control, it is referred to as the "billion dollar pest." By this discovery Inspector Swartsel very likely prevented the establishment of this insect in Florida.

Inspections Made

Following is a tabular statement of the inspection work by the Quarantine Department from May 1 to September 30, 1918:

VESSELS INSPECTED:			
From foreign ports	703		
From U. S. ports other than Florida	323		
From Florida ports	471		
Total		1497	
SHIPMENTS INSPECTED:			
Arriving by water—			
Passed	11,833		
Treated and passed	100½		
Returned to shipper	143		
Detained, subject to return by shipper	0		
Contraband destroyed	786½		
Total		12,863	
Arriving by land—Express, freight, wagons, etc.			
Passed	1,336		
Treated and passed	127		
Returned to shipper	71		
Detained, subject to return by shipper	36		
Contraband destroyed	41		
Total		1611	
Total shipments inspected			14,474

Parcel Post Plant Inspection

The inspection of plant products being sent by mail to Florida postoffices has been continued in the manner outlined in our main report (see page 61).

Owing to the lack of co-operation in turning over to the Plant Board agents material subject to inspection and on account of many postmasters not fully understanding the importance of this inspection work it was decided in August, 1918, to have Special Inspector Kirkland S. Lamb call in person upon postmasters and secure their co-operation. Between August 17th and September 30th, Mr. Lamb called upon and interviewed 120 postmasters, securing their promise of co-operation. During the same period Mr. Lamb called upon 149 freight and express agents in the towns visited, for the purpose of seeing that they understood the various rules and regulations of the Board concerning shipment of nursery stock, sweet potato plants, etc. The results thus far obtained show that the plan of having an inspector personally confer with postmasters and transportation agents is productive of much good and is a practice for which provision should be made during the next two years as indicated in our main report (page 62).

Parcels Inspected

Following is a tabular statement of the parcel post packages of plants and plant products inspected by the Board's agents between May 1 and September 30:

PARCELS INSPECTED:		
Passed	831	
Treated and passed	43	
Returned to sender	0	
Detained, subject to return by sender	7	
Infested or infected parcels destroyed	6	
Total parcels inspected		887

Sweet Potato Weevil

Additional infested points have been found in counties already known to contain one or more infested localities. Inspectors of the Plant Board and of the Bureau of Entomology, U. S. Dept. of Agriculture, found infestations at Punta Rassa, Fort Myers and Useppa Island in Lee County, at Deerfield in Broward County, Delray in Palm Beach County, Rio, Oslo and Vero in St. Lucie County, Tarpon Springs in Pinellas County and Ormond Beach in Volusia County.

The insect has also been found infesting two species of morning glories not heretofore found infested in Florida, namely, *Ipomoea pandurata* and *Ipomoea littoralis*. The first-named morning glory prefers high sandy land while the second grows along the seacoast.

The Plant Board's efforts to prevent spread of the weevil from the areas already infested, by means of suitable quarantines, are being continued.

Banana Root Borer

Further investigation showed that the area in Manatee County infested with this insect comprised 14 properties, in addition to the one first found infested. There were on these properties 14,675 banana plants, not including one banana field of 1½ acres of closely matted plants. Further spread of the pest could be prevented only by the destruction of the infested plantings. The necessary permission for this step was in all cases secured from the owners, and Assistant Nursery Inspector Howard B. Swartsel was detailed to supervise the task. On May 8, 1918, the assistance of the Federal Horticultural Board, U. S. Department of Agriculture, was secured, the Board through its Chairman, Mr. C. L. Marlatt, kindly offering to pay a part of the cost of disposing of the infested plantings. During May and June all the infested plantings were destroyed. During this period the Federal Horticultural Board defrayed labor expenses to the amount of $284.25. As soon as the infested plantings were destroyed, "traps" for any remaining weevils were put into use, as explained on p. 72 of the foregoing report. This trapping is still being continued in the hope of getting absolutely all of the banana root-borer weevils. This work is now being done by Mr. A. F. Collins, a local grower.

Available funds have not yet permitted of a systematic inspection of all shipments of banana plants made from the south Florida nursery which was found infested with the banana root-borer in March, 1918. In co-operation with the Federal Horticultural Board, however, the owners of all these plantings have been written to and in all cases where the owner reported his banana plants as being unhealthy or having died an inspector was detailed to make an inspection of them. Such inspections as have been made have brought to light one infested property located in Polk County. This infestation was found on September 16, 1918, by Assistant Nursery Inspector W. C. Nanney. With the owner's consent all banana plants in this planting were destroyed at once. Inspection of all nearby banana plantings did not reveal infestation and led to the conclusion that the insect had not spread from this one planting, which was made with banana plants from the infested nursery referred to.

Black Fly

Mention was made in our main report (page 75) of Messrs. L. Russel Warner and H. D. Bollinger having been employed by the Office of Plant Sanitation in Havana to assist in control of the black fly. Mr. Bollinger returned to Florida on June 1st and Mr. Warner on August 1st. With their co-operation and assistance the Office of Plant Sanitation made good progress, during the late winter and spring months, in its fight on the pest in Havana, greatly reducing the degree of infestation and reducing correspondingly the chances of the insect being brought to Florida on vessels from Havana.

Our efforts to prevent the introduction into this State of the black fly have not been relaxed in any degree. On the contrary the quarantine measures have been made more stringent. Reports from our inspectors located at Key West and Tampa showed that fruit shipments from Cuba frequently contained leaves and other material likely to transmit the black fly. Efforts to have the shippers abate this practice proving ineffective, the Plant Board, at its meeting on July 12, 1918, instructed the Plant Commissioner to order the deportation of all packages of fruit arriving from Cuba containing leaves, twigs, etc. This order became operative August 1st. Prior to this date the Cuban Government was notified of the action of the Board and wide publicity obtained.

The records of this department show that during the period from May 1 to September 30, 1918, there arrived at Key West and Port Tampa from Cuba 42,834 packages of fruit. Of this number 16,834 packages came in after the time when the Board's order went into effect. The task of inspecting these packages was one of magnitude but was accomplished. Due to publicity given the order in Cuba shippers were more careful in preparing shipments. Even so our inspectors detected the presence of prohibited material in 81 packages of fruit. These were deported.

Pink Bollworm Quarantine

Reports from the authorities in charge of the Pink Bollworm eradication work in Texas have continued to show lack of full co-operation of cotton growers in the infested area, as well as failure on the part of the courts to enforce the Texas bollworm law. These reports were of such a nature as to make inadvisable any modification of the Plant Board's quarantine. On the contrary the need of greater precaution was evident and on May 10, 1918, the Board amended its Rule 37, dividing it into Rules 37A and 37B and adding an aditional safeguard by prohibiting the shipment into Florida of cotton linters, cotton waste, samplings, sweepings and damaged cotton from points east of the Mississippi River except on permits of the Plant Commissioner, issued after the receipt of satisfactory assurances as to the safety of the shipments in question.

In applying these regulations the agents of the Board at Jacksonville have on several occasions intercepted cotton shipments coming from the vicinity of the infested Texas area. Such shipments have been deported from Florida without delay.

DEPARTMENT OF ENTOMOLOGY

The work of this Department has continued without interruption. During this period 901 cultures of the red whitefly fungus have been distributed, as have also 193 cultures of the yellow Aschersonia for the control of the woolly whitefly. In connection with control of the cottony cushion-scale, 60 colonies of the Australian lady-bird beetle have been distributed to growers. Eight hundred and fifty-six specimens of insects, mostly injurious, have also been received and identified.

The Entomologist rendered special and valuable service in connection with the severe outbreaks of the semi-tropical army worm during July. This outbreak is discussed more in detail below.

DEPARTMENT OF PLANT PATHOLOGY

In view of the need of technical advice and information regarding various plant diseases on the part of its staff, the Plant Board, at its meeting on May 10, 1918, elected Prof. H. E. Stevens, Plant Pathologist of the University of Florida Experiment Station, to the position of "Consulting Plant Pathologist" of the Plant Board. Prof. Stevens' appointment to this position became effective July 1, 1918, at a salary of $400.00 per annum.

Prof. Stevens is called upon from time to time to identify specimens of plant diseases taken in connection with the inspection and quarantine work, answers inquiries from farmers and growers concerning plant diseases, etc.

SEMI-TROPICAL ARMY WORM

The past spring a large acreage of castor beans was planted in Florida, under Government contracts, for the purpose of supplying beans from which castor oil could be made for aeroplane motors.

The semi-tropical army worm is an insect which is found every year in Florida, usually in such small numbers that it does not attract attention. A few of these worms were reported about the middle of June, by District Inspector A. L. Swanson, as feeding on castor bean plants in Palm Beach County.

About the middle of July the pest appeared in very considerable numbers and by July 23rd the outbreak had assumed a serious phase, particularly in St. Lucie, Palm Beach, Dade, Hillsborough, Polk and DeSoto Counties.

On July 23rd the Plant Commissioner wired instructions to the District Inspectors in the East Coast counties from Brevard to Dade to place practically all citrus canker inspectors at work assisting castor bean and cotton growers in combating the worms. At about the same time telegrams were received from the Miami Chamber of Commerce, contractors and others, asking the Plant Board's assistance in the emergency.

On July 24th it became evident that the army worms were so abundant in parts of Hillsborough, Polk and DeSoto Counties that several thousand acres of castor beans there were threatened with destruction. Accordingly inspectors in the employ of the Plant Board in central and western Florida were also placed on the army worm work.

The inspectors made personal visits to all castor bean growers in the affected territory, inspected the castor bean fields and in each instance called attention of the owner to the presence of the pest in his field and advised him how to control it. In many instances where the worms had, at the time of the inspector's visit, reached sufficient size to do considerable damage, the inspectors themselves sprayed the castor bean fields with powdered arsenate of lead, using dust sprayers for the purpose, a supply of both being carried by the inspectors at all times.

The fight against the army worm was waged intensively until about August 12th, by which time the pest had been brought under control and appreciable damage averted except in the case of a few fields where the worms had practically destroyed all foliage on the bean plants before the fields could be reached by the inspectors.

In this work the Plant Board agents were assisted by agents of the Bureau of Entomology and Bureau of Plant Industry, U. S. Department of Agriculture, by the Government's castor bean contractors and, in some instances, by the county demonstration agents. As soon as the seriousness of the situation became apparent the Bureau of Aircraft Production at Washington was appealed to for supplies of powdered lead arsenate with which to treat the infested fields. The Bureau purchased 5500 pounds of the poison and had it shipped to Florida for distribution under the Plant Commissioner's direction to castor bean growers who needed it. For various reasons this material did not arrive until the fight against the worms was practically won and but a few hundred pounds were therefore actually used.

In dealing with the emergency created by this outbreak of the army worm the Plant Board was called upon to make rather heavy expenditures. A total of $1,946.85* was expended by the Board, covering traveling expenses of inspectors, telegrams, emergency circulars, dusting machines, poison, etc. The large quantity of castor beans saved from destruction, and therefore made available for the use of the Government, more than justified the expenditure.

Writing under date of August 15, 1918, one of the Government's castor bean contractors said:

> "I cannot say with any degree of accuracy how many thousands of dollars the State Plant Board has saved in the army worm fight. I would say that you have certainly saved whatever our castor bean crop results in at the end of the season."

Another contractor, under date of August 18th, wrote the Plant Commissioner in part as follows:

> "We wish to make acknowledgment to the State Plant Board of our appreciation of the splendid work done and the great public service performed during the past month by the inspectors of the Board in combating the army worms. So far as the castor bean crop is concerned, its money value is probably of smaller consequence than its military importance, and for this reason the prompt and effective work of your inspectors in aiding to save the crop has been of value to the Nation of such importance as can now only vaguely be guessed. It may be that in helping to save the castor beans your men have done much to help win the war. That the army of

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*Distributed as follows: Out of Plant Act General Fund; salares $84.44. Out of Special Fund; salaries $262.22, and expenses $1,600.19. Salaries of other inspectors on army worm work were defrayed by the U. S. Dept. of Agriculture.

"minute men" of the Plant Board was thrown into action within a few hours after the first appeal to you for aid, speaks volumes for the efficiency of your organization and the fine sense of public duty and responsibility held by the Plant Board."

The Chairman of the Plant Board and the Plant Commissioner, respectively, were also in receipt of letters from the Office of the Director of Aircraft Production, thanking the Board for its activities in preventing damage to the Florida castor bean crop.

Following the middle of August, damage by the semi-tropical army worm was on the wane, due largely to the increase of parasites with each succeeding generation of the worms.

FINANCIAL REPORT

Tallahassee, Florida, October 1, 1918.

To the State Plant Board of Florida:

Gentlemen: I have the honor to submit the following report of the finances of the Board for the period beginning May 1, 1916, and ending April 30, 1918. I am also submitting an additional report for the period beginning May 1, 1918, and ending September 30, 1918, but this does not include expenditures for September, approved at the October meeting of the Board:

SUMMARY

Resources

General appropriation for fiscal year ending April 30, 1917	35,000.00	
General appropriation for fiscal year ending April 30, 1918	35,000.00	
Balance Donations and Incidental Collections Fund after paying bills for April, 1916	2,632.64	
Donations and Incidental Collections from April 30, 1916, to April 30, 1918	11,066.44	
Balance in Special Appropriation after paying expenses for April, 1916	16,007.95	
Special Appropriations for Citrus Canker Eradication, etc.	150,000.00	
Total Resources		$249,707.03

Expenditures

For Salaries	$156,758.74	
For Office Supplies	6,759.89	
For Traveling Expenses	35,335.04	
For Printing Bulletins	6,352.97	
For General Supplies	9,780.80	
For Miscellaneous Expenses	3,901.31	
Unexpended part of General Appropriation	57.50	
Total Expenditures		$218,946.25
Balance after expenditures for April, 1918, are deducted		$ 30,760.78

ITEMIZED EXPENDITURES

GENERAL FUND

Resources

General Appropriation for fiscal year ending April 30, 1917	$ 35,000.00	
General Appropriation for fiscal year ending April 30, 1918	35,000.00	
Total Resources		$ 70,000.00

Expenditures

For Salaries	$ 52,505.86	
For Office Supplies	4,540.68	
For Traveling Expenses	7,123.69	
For Printing Bulletins	2,429.91	
For General Supplies	2,756.21	
For Miscellaneous Expenses	586.15	
Refund of unexpended balance, 1917	56.87	
Refund of unexpended balance, 1918	.63	
Total Expenditures		$ 70,000.00*

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*The disbursement of the General Fund for the fiscal year ending April 30, 1917, classified by departments rather than by items, was as follows:

Plant Board, Expenses	$ 87.81	
Advisory Committee, Expenses	56.60	
Secretary's Office (Tallahassee)	1,213.93	
Plant Commissioner's Office (Gainesville)	12,165.13	
Department of Entomology	4,560.67	
Department of Nursery Inspection	7,170.78	
Department of Plant Pathology	521.48	
Department of Port & Railway Inspection	9,166.73	
Unexpended balance reverting	56.87	
Total		$35,000.00

Disbursement of the General Fund for the fiscal year ending April 30, 1918, by departments, was as follows:

Plant Board, Expenses	$ 1,040.02	
Secretary's Office	1,502.62	
Plant Commissioner's Office	11,514.56	
Department of Entomology	5,380.61	
Department of Nursery Inspection	8,640.25	
Department of Port & Railway Inspection	6,921.31	
Unexpended balance reverting	.63	
Total		$35,000.00

—Plant Commissioner.

SPECIAL FUND

Resources

Amount unexpended after paying expenses for April, 1916	$ 16,007.95	
Appropriation by Legislature for Citrus Canker Eradication, etc., available July 1, 1917	150,000.00	
Total Resources		$166,007.95

Expenditures

For Salaries	$ 96,918.57	
For Office Supplies	2,159.05	
For Traveling Expenses	27,974.46	
For Printing Bulletins	3,911.11	
For General Supplies	3,531.29	
For Miscellaneous Expenses	3,144.37	
Total Expenditures		$137,638.85†
Unexpected balance after paying April, 1918, expenses		$ 28,369.10

DONATIONS AND INCIDENTAL COLLECTIONS

Resources

Unexpended balance after paying expenses for April, 1916	$ 2,632.64	
Donations and Incidental Collections from April 30, 1916, to April 30, 1918	11,066.44	
Total Resources		$ 13,699.08

Expenditures

For Salaries	$ 7,334.31	
For Office Supplies	60.16	
For Traveling Expenses	236.89	
For Printing Bulletins	11.95	
For General Supplies	3,493.30	
For Miscellaneous Expenses	170.79	
Total Expenditures		$ 11,307.40
Balance unexpended after paying April, 1918, expenses		$ 2,391.68

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†This sum, during the two fiscal years ending April 30, 1918, was expended for the following purposes:

Citrus Canker Eradication	$119,718.57	
Nursery Inspection	10,436.64	
Plant Disease Investigations and Control	836.61	
Quarantine Work and Inspection	6,633.15	
Preventing Spread of Sweet Potato Weevil	13.88	
Total		$137,638.85

—Plant Commissioner.

SUPPLEMENTARY REPORT, FROM APRIL 30, 1918, TO SEPTEMBER 30, 1918

GENERAL FUND

Resources

General Appropriation for fiscal year ending April 30, 1919	$ 35,000.00	
		$ 35,000.00

Expenditures

For Salaries	$ 4,141.78	
For Office Expenses	495.81	
For Traveling Expenses	431.00	
For Printing Bulletins	151.30	
For General Supplies	908.35	
For Miscellaneous Expenses	28.14	
Total Expenditures		$ 6,156.38*
Balance Unexpended September 30, 1918		$ 28,843.62

SPECIAL FUND

Resources

Unexpended Balance after paying expenses for April, 1918	$ 28,369.10	
Special Appropriation for Citrus Canker Eradication, etc., available July 1, 1918	150,000.00	
Total Resources		$178,369.10

Expenditures

For Salaries	$ 26,114.69	
For Office Supplies	3,683.21	
For Traveling Expenses	14,483.53	
For Printing Bulletins	907.17	
For General Supplies	1,486.35	
For Miscellaneous Expenses	211.96	
Total Expenditures		$ 46,886.91†
Balance unexpended September 30, 1918		$131,482.19

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*Does not include expenses incurred during September, 1918, vouchers for which were approved at the October meeting of the Board.

†Bills for the month of September (which were approved by the Board at its October meeting) not included.

DONATIONS AND INCIDENTAL COLLECTIONS

Resources

Unexpended Balance after paying expenses for April, 1918	$ 2,391.68	
Receipts from April 30, 1918, to September 30, 1918	2,308.89*	
Total Resources		$ 4,700.57

Expenditures

For Salaries	$ 642.53	
For Office Expenses	1.02	
For Traveling Expenses	8.54	
For Printing Bulletins	21.60	
For General Supplies	195.00	
For Miscellaneous Expenses	4.38	
Total Expenditures		$ 873.07†
Balance unexpended September 30, 1918		$ 3,827.50

Total Balance Unexpended (September, 1918, bills outstanding and awaiting approval at October meeting of Board), all funds, September 30, 1918:

General Fund	$ 28,843.62	
Special Fund	131,482.19	
Incidental Fund	3,827.50	
		$164,153.31

Respectfully submitted,
BRYAN MACK,
Secretary.

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*Does not include collections for the month of September. These were reported to the Board at its October meeting.

†Does not include bills for the month of September. These were approved by the Board at its October meeting.

ESTIMATES

The following estimates on the amounts of money required for protecting the agricultural industries of Florida, through the work of the State Plant Board in carrying out the provisions of the Florida Plant Act of 1915, are based upon a careful study of the enormous inroads made upon Florida crops and fruits by injurious insects and plant diseases, as well as upon the urgent necessity of protecting the State against invasion by several very destructive pests in the countries and islands with which commercial intercourse is either frequent or constant.

Full regard has been had to economy in the past work of the Board, as well as in preparing estimates for future needs: it being realized, however, that judicious expenditure of funds for preventing crop losses brings a return to our citizens many fold greater than the investment.

Owing to conditions prevailing during the past two years the Board has been compelled to pay its employees higher salaries than formerly. Prices of all supplies have greatly advanced and all expenses in connection with the Board's work have shown unavoidable increases. With full regard for these considerations it is believed that the estimates here given are no more than is necessary to afford adequate protection to the State's principal agricultural industries.

The various activities to which these estimates refer and the necessity therefor are quite fully explained in the foregoing pages of this report.

GENERAL FUND

Estimated Expenses per Annum*

Plant Board

Traveling Expenses, Board Members	$ 1,200.00	
Postage	350.00	
Telegrams and telephone messages	100.00	
Stenographer, Chairman's Office	1,200.00	
Stationery and Filing Cases	120.00	
Total		$ 2,970.00

Secretary's Office

Salary, Secretary	$ 1,200.00	
Traveling Expenses, Secretary	300.00	
Postage, Stationery and Telegrams	500.00	
Total		$ 2,000.00

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*See page 82.

Plant Commissioner's Office

Salaries:		
Plant Commissioner	$ 4,500.00	
1 Chief Clerk	1,800.00	
1 Filing Clerk	900.00	
4 Stenographers at $85.00 per month	4,080.00	
1 Janitor at $40.00 per month	480.00	
Total Salaries		$ 11,760.00
Traveling Expenses, Plant Commissioner	$ 400.00	
Postage and Stamped Envelopes	1,000.00	
Telephone and Telegrams	140.00	
Letterheads, Plain White Paper, Envelopes, etc.	240.00	
Office Desks, Tables and Chairs	40.00	
Filing Furniture	100.00	
Filing Folders, Guide and Record Cards, Blank Books, etc.	150.00	
Typewriter Maintenance	350.00	
Express, Drayage and Freight	160.00	
Multigraph Supplies and Maintenance	160.00	
Publication of Quarterly Bulletin,* 4 issues, 10,000 copies per issue, @ $700	2,800.00	
Postage on Quarterly Bulletin at second-class rate, 4 issues, @ $18.00 per issue	72.00	
Publication of Plant Board "Circulars" containing Rules, Regulations and Public Notices of the Board as Adopted, 12 issues, 5,000 copies each, at $30.00 per issue	360.00	
Electricity†, 12 months at $8.00 per month	96.00	
Heat†, 4 months at $18.00 per month	72.00	
Reference Books and Technical Publications	240.00	
		$ 6,380.00
Total, Plant Commissioner's Office		$ 18,140.00

Department of Nursery Inspection

Salaries:		
Nursery Inspector (Chief of the Department)	$ 2,500.00	
14 Assistant Nursery Inspectors at $1,800.00 per annum	25,200.00	
4 Stenographers at $85.00 per month	4,080.00	
1 Invoice and Certificate Clerk	1,500.00	
Total, Salaries		$ 33,280.00
Traveling Expenses:		
Nursery Inspector	$ 500.00	
14 Assistant Nursery Inspectors at $100.00 per month average	16,800.00	
		$ 17,300.00
Postage	$ 900.00	
Stationery	190.00	
Telegrams	80.00	
Typewriter Maintenance, Filing Material and Record Blanks	350.00	
		$ 1,520.00
Total, Department of Nursery Inspection		$ 52,100.00

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*In lieu of all other expenses for publishing bulletins, except rules of the Board as adopted, and official notices to transportation companies.

†Payable to the University of Florida.

Quarantine Department

Salaries:		
Quarantine Inspector (Chief of Department)	$ 2,500.00	
6 Asst. Quarantine Inspectors at $1,800.00 per annum	10,800.00	
4 Asst. Quarantine Inspectors at $1,600.00 per annum	6,400.00	
1 Stenographer	1,200.00	
Total, Salaries		$ 20,900.00
Traveling Expenses:		
Quarantine Inspector	650.00	
3 Asst. Quarantine Inspectors at $600.00 per annum	1,800.00	
		$ 2,450.00
Postage	$ 600.00	
Telegrams and Telephone Messages	140.00	
Stationery, Record Cards, Filing Equipment, etc	350.00	
Port Expenses (Boat Hire, Street Car Fare, Quarantine Tags, Labor in Handling Shipments, etc.)	690.00	
Typewriter Maintenance	100.00	
Publication of Quarantine Inspection Notices, estimated 5 issues of 5,000 copies each, at $25.00 per issue	125.00	
Express, Drayage and Freight	30.00	
		$ 2,035.00
Total, Quarantine Department		$ 25,385.00

Parcels-Post Plant Inspection*

Salaries:		
2 Deputy Inspectors at $1,800.00 per annum	$ 3,600.00	
Traveling Expenses:		
1 Deputy Inspector at $100.00 per month	1,200.00	
Disinfectants, Fumigating Material, Tags, etc.	120.00	
Drayage on Parcel Post Packages for Inspection, between postoffice and University at Gainesville, at $5.00 per month	60.00	
Total, Parcel Post Plant Inspection		$ 4,980.00

Eradication of Sweet Potato Weevil

For preventing the spread of sweet potato weevil, control of same in infested localities, and beginning of eradication work	$ 24,000.00

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*Under an order issued by the Third Assistant Postmaster-General on October 24, 1916, all mail shipments of plants and plant products addressed for delivery at Florida postoffices are required sent to Gainesville for inspection by the State Plant Board. Subsequent to October 24, 1916, terminal inspection service was established at Jacksonville, Tampa and Pensacola, in addition to Gainesville.

Department of Entomology

Salaries:		
Entomologist (Chief of Department)	$ 2,600 00	
1 Assistant Entomologist	2,000.00	
1 Assistant Entomologist	1,600.00	
1 Stenographer at $85.00 per month	1,020.00	
Labor	250.00	
		$ 7,470.00
Traveling Expenses:		
Entomologist	$ 300.00	
2 Assistant Entomologists	800.00	
		$ 1,100.00
Postage	$ 200.00	
Laboratory Supplies	550.00	
Express, Freight and Drayage	50.00	
Reference Books and Publications	225.00	
Furniture and Laboratory Equipment	310.00	
Photographic Supplies	75.00	
Insect Cases, Labels and Record Files	100.00	
Chemicals and Laboratory Reagents	85.00	
		$ 1,595.00
Total, Department of Entomology		$ 10,165.00

Department of Plant Pathology

Salaries:		
Consulting Plant Pathologist	$ 400.00	
Stationery and Laboratory Supplies	100.00	
Photographic Equipment	50.00	
Postage	25.00	
Total, Department of Plant Pathology		$ 575.00

Summary

Plant Board Expenses	$ 2,970.00	
Secretary's Office	2,000.00	
Plant Commissioner's Office	18,140.00	
Department of Nursery Inspection	52,100.00	
Quarantine Department	25,385.00	
Parcels-Post Plant Inspection	4,980.00	
Eradication of Sweet Potato Weevil	24,000.00	
Department of Entomology	10,165.00	
Department of Plant Pathology	575.00	
Grand Total, General Fund, per Annum		$140,315.00

Citrus Canker Eradication*

For continuing the eradication of citrus canker and inspection of citrus groves for the disease:

For the fiscal year ending June 30, 1920	$125,000.00
For the fiscal year ending June 30, 1921	100,000.00
Total	$225.000.00

Respectfully submitted,

Gainesville, Fla.,
November 30, 1918.

WILMON NEWELL,
Plant Commissioner.

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*See page 82.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*........*Editor*

ASSOCIATE EDITORS.

E. W. BERGER	*Entomologist*
F. M. O'BYRNE	*Nursery Inspector*
FRANK STIRLING	*General Inspector*
J. H. MONTGOMERY	*Quarantine Inspector*
H. E. STEVENS	*Consulting Plant Pathologist*

Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK FOR QUARTER ENDING DECEMBER 31, 1918.*

Citrus grove trees inspected	2,068,199
Citrus nursery trees inspected	12,873,595
Inspectors employed	179
New properties showing infection	0
Total properties showing active infection	0
Grove trees found infected	0
Nursery trees found infected	0
Counties in which active infections were found	0

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,723
Nursery trees found infected since May, 1914	342,254
Number properties infected to December 31, 1918	480
Properties declared no longer "danger centers"	475
Properties still classed as "infected" December 31, 1918	5

*Compiled by Mr. Frank Stirling, General Inspector.

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to December 31, 1918:

1914		1915		1916		1917		1918	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1
		Mar.	444	Mar.	49	Mar.	9	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2
May	108	May	1042	May	338	May	52	May	1
June	160	June	772	June	450	June	45	June	10
July	275	July	651	July	349	July	39	July	0
Aug.	1318	Aug.	1345	Aug.	219	Aug.	30	Aug.	0
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING DECEMBER 31, 1918.*

SHIPS AND VESSELS INSPECTED:			
From foreign ports	423		
From U. S. ports other than Florida	179		
From Florida ports	213		
Total		815	
PARCELS INSPECTED:			
Arriving by water:			
Passed	6212½		
Treated and passed	7		
Returned to shipper	115		
Detained, subject to return by shipper	0		
Contraband destroyed	222½		
		6557	
Arriving by land—express, freight, wagons, etc.:			
Passed	8557½		
Treated and passed	80		
Returned to shipper	74		
Detained, subject to return by shipper	61		
Contraband destroyed	83½		
		8856	
Total parcels inspected			15413

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*Compiled by J. H. Montgomery, Quarantine Inspector, and K. E. Bragdon, Asst. Quarantine Inspector.

PRINCIPAL PESTS AND DISEASES INTERCEPTED

Insect or Disease	Occurring on	From	Number of Parcels infested
Aphis, sp.	Palm	Unknown point	1
Aspidiotus sp.	Cassava	Cuba	1
Aspidiotus cocotiphagus	Cocoanut palm	Cuba	1
Aspidiotus cocotiphagus	Cocoanut palm	Florida	1
Bamboo scale	Bamboo	Florida	1
Boll worm	Corn	Cuba	1
Cactus scale	Cactus	Florida	1
Calandra oryzae	Sweet potato	Florida	1
Cigarette beetle	Cassava	Cuba	1
Citrus scab	Citrus	Alabama	1
Cottony cochineal	Cactus	Florida	1
Cottony cochineal	Fig	Florida	1
Crown gall	Hibiscus	Florida	1
Dictyospermum scale	Rose	Virginia	1
Florida red scale	Rubber plant	Florida	1
Grape root worm	Grape	North Carolina	1
Gypsy moth	Birch	Massachusetts	2
Lesser snow scale	Hibiscus	Unknown point	1
Long scale	Citrus	Florida	1
Mealy-bug	Unknown ornamental	Georgia	1
Nematode root-knot	Fig	Georgia	1
Nematode root-knot	Fig	South Carolina	1
Nematode root-knot	Peach	Florida	3
Nematode root-knot	Plum	Georgia	1
Noctuid moth	Rose	Maine	1
Oleander scale	Palm	Unknown point	1
Oyster-shell scale	Ash	Maine	1
Oyster-shell scale	Birch	Maine	1
Peach-tree borer	Peach	Florida	1
Peach-tree borer	Peach	Georgia	1
Pineapple scale	Palm	Florida	2
Purple scale	Citrus	Florida	3
Putnam's scale	Plum	Unknown point	1
Rose scale	Rose	Maine	1
Rufous scale	Rose	Florida	1
San Jose scale	Cherry	Virginia	1
San Jose scale	Peach	Georgia	2
San Jose scale	Peach	Florida	2
San Jose scale	Peach	South Carolina	1
San Jose scale	Peach	Virginia	1
San Jose scale	Plum	Florida	1
San Jose scale	Plum	Georgia	1
San Jose scale	Rose	Florida	1
Scurfy scale	Cherry	Virginia	1
Sweet potato scarabee	Sweet potato	Porto Rico	1
Sweet potato weevil	Sweet potato	Cuba	2
Sweet potato weevil	Sweet potato	Texas	1
Tent caterpillar	Birch	Maine	1
West Indian peach scale	Persimmon	Florida	1
Whitefly	Citrus	Alabama	1
Whitefly	Citrus	Florida	3
Woolly apple aphis	Apple	North Carolina	1

PARCEL POST PLANT INSPECTION

PARCELS INSPECTED:		
Passed	293	
Treated and passed	4	
Returned to sender	1	
Detained, subject to return by sender	0	
Contraband destroyed	1	
Total parcels inspected		299

PRINCIPAL PESTS AND DISEASES INTERCEPTED

Insect or Disease	Occurring on	From	Number of Parcels infested
Aphis sp.	Rose	Unknown point	1
Chaff scale	Citrus	Florida	1
Latania scale	Fig	Florida	1
Lecanium corni	Cherry	Unknown point	1
Oleander scale	Palm	Illinois	1
San Jose scale	Rose	Unknown point	1
Whitefly	Citrus	Florida	1
White peach scale	Unknown plant	Florida	1

THE QUARTERLY BULLETIN

State Plant Board of Florida

Vol. III APRIL, 1919 No. 3

IMPORTANT ANNOUNCEMENT

The circulation of the Quarterly Bulletin has now reached such a point that the expense of publication is a very considerable item. It therefore becomes necessary, for reasons of economy, to give our mailing list a severe revision, eliminating from the list the names of all those who are no longer interested in the Bulletin or do not have particular need for it.

The Quarterly Bulletin is the only publication in Florida devoted exclusively to the practical control of injurious insects and plant diseases and to their prevention and eradication. That it has accomplished something along this line is attested by the many kind comments from Florida citizens and unusually frequent and complimentary mention by officials and publications in other states and countries.

The Bulletin is sent free to all Florida citizens who request it, and it will be our policy to continue sending the Bulletin to such citizens as have real need for it, provided that the funds placed at the disposal of the Board for the coming two years admit of its continued publication.

With this number will be enclosed a return postal card. If you wish to continue receiving the Quarterly Bulletin fill out and return this card before July 1, 1919. Otherwise your name will be dropped from the mailing list.

STATISTICS ON THE CITRUS PLANTINGS IN FLORIDA

WILMON NEWELL AND FRANK STIRLING

In connection with the work of eradicating citrus canker in Florida, employees of the Plant Board and Bureau of Plant Industry have made careful records of the number of citrus trees contained in each and every planting inspected. In the attempt to locate all centers of canker infection rapid inspections, known as "scout inspections" have been made of all sections of the State, the first scout inspection of the State having been completed on February 28, 1919, after nearly four years of work.

It is believed that the records made in connection with these inspections constitute the most complete and accurate statistics ever secured in connection with any horticultural industry in any state, for it has been the effort of the inspectors to not only see every citrus tree in Florida but, at the same time, to make a record of it. The number of citrus trees in each county and in the State as a whole, has been compiled by Mr. Stirling from the inspection reports on the 47,401 properties inspected since May 1, 1915, and is given herewith.

A number of interesting facts are brought out by these figures. For one thing, the acreage devoted to citrus production in Florida constitutes approximately 10 per cent. of the total acreage in cultivation and the acreage devoted to citrus growing makes up 96 per cent. of the acreage given over to fruit production in the State.

The total acreage devoted to citrus trees in grove formation is found to be 160,397, of which 115,324 acres are of bearing age and 45,073 are non-bearing. The line of distinction between bearing and non-bearing trees has been arbitrarily placed at three years. That is, inspectors have reported as "bearing" all groves which, at time of inspection, had been planted out for three years or more and have reported as "non-bearing" all plantings of less than three years of age. While it is readily conceded that a grove planted out but three years can hardly be considered as actually in bearing, it is to be remembered that plantings which were three years of age when reported by the inspectors in 1915, are now 7 years of age, those reported in 1916 are now 6 years of age, etc., so that the proportion of bearing and non-bearing trees arrived at by this method is perhaps as near to the actual proportion as can be arrived at by any available method.

The following table shows the acreage in citrus in each county and also the number of citrus growers owning the trees. Many of the citrus growers have small plantings, no distinction being made in the statistics between those producing fruit on a commercial scale and those who are not. At the same time, it is conservatively estimated that fully 80 per cent. of the growers produce citrus fruits in marketable quantities.

The table on next page takes no account of citrus nursery stock. Figures on the nursery acreage are, however, readily available from the records kept in the office of Mr. F. M. O'Byrne, Nursery Inspector for the Plant Board. According to these records the total number of marketable citrus trees in Florida nurseries, on April 30, 1918, was 13,016,752.

CITRUS PLANTINGS IN FLORIDA

Statistics Compiled by State Plant Board in Actual Inspections for Citrus Canker to February 28, 1919

County	Acres, Bearing	Acres, Non-Bearing	Trees, Bearing	Trees, Non-Bearing	Citrus Growing Properties
Alachua	696	45	48736	3160	634
Baker	26	25	1843	1738	89
Bay	33	24	2303	2361	396
Bradford	38	5	2681	334	196
Brevard	4996	2784	349746	194901	2664
Broward	387	489	27123	34229	334
Calhoun	53	15	3724	1096	31
Citrus	397	35	27776	2483	174
Clay	89	8	6217	580	165
Columbia	11	3	789	229	140
Dade	7720	2752	540432	192616	2050
Duval	355	105	24861	7339	1259
DeSoto	9272	2806	649063	196461	2387
Escambia	116	97	8131	6810	429
Flagler	107	35	7479	2442	95
Franklin	24	7	1687	488	23
Gadsden	1	2	74	120	50
Hamilton	2	2	103	115	35
Hernando	805	104	56346	7329	618
Hillsboro	6955	4367	486841	305701	4298
Holmes	4	2	292	137	25
Jackson	3	1	244	69	74
Jefferson	19	54	1379	3829	372
LaFayette	9	7	622	..507	115
Lake	9788	1706	685213	119452	2534
Lee	6146	2206	430216	154435	1764
Leon	16	63	1134	4440	350
Levy	29	1	2098	55	65
Liberty	0	24	5	1716	9
Madison	8	13	574	947	226
Manatee	4872	2388	343593	169799	989
Marion	4519	402	316369	28188	643
Monroe	1409	152	211433	22718	547
Nassau	2	1	138	60	33
Okaloosa	12	6	854	425	47
Okeechobee	68	8	4745	535	28
Orange	9882	3873	691745	271139	3344
Osceola	2043	1518	122580	91080	1436
Palm Beach	1313	734	91881	51357	2108
Pasco	1511	693	105843	48535	987
Pinellas	8659	2973	606144	208144	4682
Polk	13795	8830	965635	618165	3844
Putnam	3713	464	259958	32501	1068
St. Johns	390	50	27359	3503	608
St. Lucie	3614	3485	253014	243923	1458
Santa Rosa	81	19	5671	1392	164
Seminole	2742	344	191955	24108	690
Sumter	1002	71	100211	7110	492
Suwannee	7	7	489	535	128
Taylor	8	7	551	520	163
Volusia	7434	1204	520387	84264	2072
Wakulla	0	2	3	181	13
Walton	141	53	9880	3691	241
Washington	2	2	136	116	15
Totals	115324	45073	8198306	3158108	47401

Total acreage in citrus groves	160,397
Total number of grove trees	11,356,414

In the table given, oranges and grapefruit are not listed separately. It is generally conceded that oranges occupy approximately 65 per cent. of the citrus acreage and grapefruit, limes and lemons the remaining 35 per cent. A careful and complete inspection of the Florida Keys, under the direction of District Inspector A. L. Swanson, during the winter of 1917-'18, revealed 2,341 acres of limes and lemons on the Keys.

A statement appearing in the February, 1919, issue of the California Citrograph, a magazine devoted to the citrus industry of California and the official organ of the California Citrus Exchange, gives the acreage planted to oranges and grapefruit in California as 172,604. This is only a little over 12,000 acres more than is devoted to these fruits in Florida and is a much smaller difference than is generally supposed. However, the lemon plantings in California, exceeding 48,000 acres, give California a marked surplus over Florida when the total of all citrus fruits are concerned. The acreage devoted to lemons in Florida is practically negligible.

THE POTATO WART DISEASE

H. E. Stevens

Potato wart is a serious disease in many of the European potato producing countries. Little was known of the disease prior to 1896, when it was first described and reported from Hungary. Since that date it has become widely distributed, invading many of the principal potato producing sections of the world. The persistent and destructive nature of this disease at once classes it as one to be avoided.

Since the first authentic report of potato wart in 1896, the disease has made rapid progress in Europe. It was reported in England in 1902. However, the disease was known to potato growers in certain districts long before this. It is a serious factor in the production of potatoes in many sections of England today. In 1908 the disease was found in several districts in Germany and had reached Ireland, where it was reported as doing considerable damage. Later, it spread to Scotland and Wales, and finally crossed the Atlantic to the shores of America. Wart was discovered in New Foundland in 1909, and recently, in 1918, specimens of this much dreaded disease were found in Pennsylvania. Thus, in little more than a decade, this newly discovered disease has spread through the principal potato growing sections of Europe and has gained an entrance into the United States.

Will the disease spread rapidly over this country and soon become an added burden to the potato grower? We trust not. We should see to it that it does not spread. The potato crop as a whole is burdened with about all the troubles it can well stand, consistent with economic production. The diseases common to the potato in this country are sufficient to cause a large annual loss to the potato crop, these losses being estimated at about $60,000,000.00. The number of diseases common to the potato in the United States is already far too large and new ones should be avoided, especially those of foreign origin. They generally prove more disastrous and more difficult to control.

Apparently, the introduction of potato wart into the United States is not yet a serious matter if proper steps are taken. Thus far the disease has only been found in a few remote districts in back yard gardens. These districts are more or less isolated from the large agricultural centers, especially those devoted to potato growing, and there is perhaps still an opportunity to wipe this pest out before it gains a foothold in our potato producing centers.

The Federal Quarantine Board was quick to act as soon as it realized the serious nature of this disease and the results of its ravages in Europe. In 1912 a quarantine was placed on all potatoes coming into the United States from countries where potato wart was known to exist. This quarantine should prevent the further introduction of this disease into the United States—but again we have apparently locked the barn door after the horse was stolen. Prior to the establishment of this quarantine in 1912, large quantities of potatoes were imported from European countries to New York, Boston and Philadelphia for table use. It was considered improbable that any infectious disease from such potatoes would ever reach the potato producing centers, since this stock would be consumed in the larger cities, away from the agricultural districts. As a means of seed tubers it is generally conceded that the European varieties are not well adapted to the United States and the foreign seed is unprofitable from a commercial viewpoint. Hence, there would be no incentive for commercial potato growers to use such stock for planting. This appeared to be a logical view of the situation and, apparently, little if any of these foreign potatoes were used in commercial plantings. The potato wart has not yet been reported from our principal potato producing centers, and it is reasonable to suppose that such districts are yet free. It could not well be present without being detected.

There were other means, however, for the introduction of this disease into this country that were not taken into account and as a result, we have a few established centers of potato wart, from which the disease may eventually spread to the potato growing sections. If all the foreign potatoes that came into New York, Boston and Philadelphia had been consumed in those cities the chances for distributing any serious pest on such stock would have been very remote. It was learned, however, that much of this stock was redistributed to interior points, going as far west as St. Louis, and south to New Orleans. Some of it may have been redistributed again and again, reaching the small towns and villages and coming nearer to the potato growing sections of the country. This redistribution has been the menace. It is not to be supposed that all of the foreign potatoes shipped to this country were diseased ones, but since these potatoes were sold for eating purposes, few precautions would naturally be taken to cull out the diseased ones or treat those that might carry disease germs. It can be taken for granted that anything that would sell for a potato was shipped.

The first report of potato wart in the United States came from a little village in the mining districts of Pennsylvania. The specimens were obtained from a back yard garden. Other back yard gardens were examined and more of the disease was found. Other villages and towns were found to contain the disease in back yard gardens, until twenty-seven towns and villages were reported as having potato wart. In some cases the infection was severe and probably of several years' standing. This points back to foreign potatoes that were shipped into the United States prior to the quarantine of 1912. This infection undoubtedly came from foreign potatoes that were used as seed, and was the result of redistribution from Philadelphia, Boston or New York. Why the disease was not reported sooner may be explained by the fact that the infected villages and towns were inhabited chiefly by foreigners who know perhaps little of the English language.

This is just the beginning of the Federal search for this disease and represents only a small area in Pennsylvania. What will be found in other states that have received shipments of these foreign potatoes remains to be seen.

The situation is brought nearer home to us here in Florida. I am informed that four cities in this State received shipments of these foreign potatoes prior to 1912. These were Jacksonville, Tampa, Key West and Pensacola. It is problematic how widely these potatoes were distributed from these cities.

It is customary for the back yard gardener to plant as seed potatoes those he may buy from his grocer, or the peelings from the potatoes used on his table. There has also been a great increase in the number of back yard gardens during the past few years and many potatoes have been planted in them. How many of such potatoes were infected with potato wart, and how many back yard gardens in Jacksonville, Tampa and Pensacola are infested with the potato wart organism?

This question should interest the Florida potato grower. This organism lives for six or eight years in the soil and rapidly increases when potatoes are grown in this infected soil. It is but a step from Jacksonville to the Hastings district. Just how serious this disease may become in Florida if once established is a matter of conjecture at the present time. Diseases of foreign origin usually prove more troublesome than our native pests, and the Florida potato grower should not willingly add this one to his burden. Again, our climatic conditions might be such that the disease would do little injury here, but the experiment of trying this out would be a risky one. The State is just passing through a costly experience with one foreign disease—citrus canker. This should serve as a lesson to keep out, or stamp out, any new invader before it becomes widely distributed. The method of combating potato wart is generally conceded to be prevention rather than remedial measures.

If the disease is present in any back yard garden in Florida it may become a menace to the potato industry of the State. If it does exist here we should discover it as soon as possible. If it does not, we can feel fortunate. A survey of the State is contemplated in the near future. The back yard gardener who grows potatoes, or any other person interested in the potato industry of Florida, can give valuable help in this search for the disease. When you dig potatoes from your garden keep this wart disease in mind and report or send in any suspicious looking specimens. Specimens for examination may be sent to the Agricultural Experiment Station, Gainesville, or the U. S. Department of Agriculture, Washington, and a report will be made on the same.

APPEARANCE.—The disease may be easily recognized by the warty outgrowths on the tubers and under ground stems. Infections on the tubers usually start at the eyes, but may occur at other points on the surface. The warts vary greatly in size, and stand out prominently on the surface. They may range from smaller than a pea to as large as a walnut. The older warts are dark brown to black in color. In severe cases the entire tuber may be converted into a spongy, warty mass.

The disease is caused by the fungus *Chrysophlyctis endobiotica.* The fungus may live for seven or eight years in soil after it is thoroughly infected.

BERTRAM O. GASTON

It was with deepest sorrow that the members of the Plant Board staff learned of the death of Inspector Bertram O. Gaston, one of the most valued and reliable men on our force. His death occurred at Kissimmee, Florida, on January 17, 1919, as a result of pneumonia, following influenza.

Mr. Gaston was born in Lowndes County, Georgia, May 3, 1891. His parents moved to Florida when he was four years of age. After completing his grammar school education he entered, at the age of 16, the employ of the Glen Saint Mary Nurseries. Later he went to Homestead, Dade County, and there engaged in the nursery business and was there when citrus canker made its appearance. Recognizing the impending calamity, Mr. Gaston vigorously took up the fight against this disease, enlisting as one of the first volunteer citrus canker inspectors under the Florida Growers' and Shippers' League in 1914. From then until his untimely death his energies and

BERTRAM O. GASTON

efforts were unstintingly given to combating this foe of the citrus industry. Appointed as an inspector of the State Plant Board in May, 1915, he rose to the position of foreman and later to that of district inspector. While in the latter position he demonstrated his ability by cleaning up one of the severest canker infections found in northern Florida.

On December 31, 1916, Mr. Gaston was married to Miss Donia Clark of Monticello, Florida.

Not content with taking the husband, the grim reaper, on February 12, 1919, took the infant son of Mr. and Mrs. Gaston. To the devoted wife and mother, in her double affliction, our hearts go out in deepest sympathy.

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING MARCH 31, 1919*

SHIPS INSPECTED:			
From foreign ports	410		
From U. S. ports other than Florida	171		
From Florida ports	372		
Total		953	
NUMBER OF PARCELS INSPECTED:			
Arriving by water:			
Passed	9824½		
Treated and passed	2928		
Returned to shipper	870		
Contraband destroyed	333½		
Total		13956	
Arriving by land—Express, Freight, Wagon, etc.:			
Passed	6260¾		
Treated and passed	26		
Returned to shipper	60		
Contraband destroyed	47¼		
Total		6394	
Arriving by mail:			
Passed	1894		
Treated and passed	533		
Returned to shipper	10		
Contraband destroyed	23		
Total		2460	
GRAND TOTAL OF PARCELS INSPECTED			22810
Total parcels passed		17979¼	
Total parcels treated and passed		3487	
Total parcels returned to shipper		940	
Contraband destroyed		403¾	
Total			22810

*Compiled by J. H. Montgomery, Quarantine Inspector, and A. C. Brown, Asst. Quarantine Inspector.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*......*Editor*

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Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING MARCH 31, 1919*.

Citrus grove trees inspected	2,243,941
Citrus nursery trees inspected	10,376,055
Inspectors employed	165
New properties showing infection	0
Total properties showing active infection	1
Grove trees found infected	1
Nursery trees found infected	0
Counties in which active infections were found	1

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,724
Nursery trees found infected since May, 1914	342,254
Number properties infected to March 31, 1919	480
Properties declared no longer "danger centers"	475
Properties still classed as "infected" March 31, 1919	5

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*Compiled by Mr. Frank Stirling, General Inspector.

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to March 31, 1919:

1914		1915		1916		1917		1918		1919	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2		
May	108	May	1042	May	338	May	52	May	1		
June	160	June	772	June	450	June	45	June	10		
July	275	July	651	July	349	July	39	July	0		
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0		
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0		
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0		
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0		
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0		

NEW FEDERAL PLANT QUARANTINE.—The attention of Florida growers and nurserymen is directed to the fact that on June 1, 1919, a new Federal quarantine goes into effect. This quarantine is known as No. 37. It is intended to, and will, more fully protect the horticultural and agricultural interests of this country and is the result of much time and effort upon the part of experts of both the Federal Government and the various State Governments. Special quarantines prohibiting entirely the importation of specific plants and plant products from certain specified countries or places remain in effect.

Regulations have been prepared supplemental to Quarantine No. 37 governing the importation of nursery stock, etc., into this country. Under these regulations importation of material for propagation can only be made under permits issued by the Federal Horticultural Board.

Those contemplating importing plants or plant products intended for or capable of propagation should communicate with the Secretary of the Federal Horticultural Board, Washington, D. C., requesting blank forms of application for permits and other detailed information. At the time of writing indicate the nature and quantity of the material to be imported, the use for which it is intended and the place of export. This information may serve to indicate to the Board whether or not permits can be issued under the provisions of the quarantine and the regulations.

A NEW WHEAT DISEASE.—Now it is a new disease of wheat, known as "Take All*", that has made its appearance in the United States. It is said to be very destructive to the wheat crop and has already been found in Illinois and several other places in the middle west. It is supposed to have become established by reason of farmers planting some of the Australian wheat which was imported early in the war for food purposes.

The desire to "try" seeds and plants from out of the way parts of the earth seems to be a mania afflicting, in greater or less degree, the entire human race. Countless pests and diseases have been brought to the United States with seeds and plants brought back by returning travelers. Annually the toll levied by these pests grows larger and annually larger and larger appropriations must be made to combat them.

Just another instance going to show the value and necessity of adequate and efficient plant quarantine service, both state and national.

**Ophiobolus graminis.*

THE QUARTERLY BULLETIN
State Plant Board of Florida

Vol. III JULY, 1919 No. 4

HOST LIST OF THE FLUTED, OR COTTONY CUSHION-SCALE

G. B. MERRILL, Asst. Entomologist

The following is a list of plants from which the Cottony Cushion or Fluted Scale, *Icerya purchasi* Maskell, has been taken, and is compiled from the references given at the end of this paper.

Due credit is given to Mr. E. R. Sasscer, Chief Inspector, Federal Horticultural Board, U. S. Department of Agriculture, for having added materially to the list from the records at Washington, to Mr. Ernest R. Barber, Scientific Assistant, U. S. Bureau of Entomology, for his list of one hundred and thirty plants found infested in Louisiana, and to Mr. F. M. O'Byrne, Nursery Inspector of the State Plant Board, for a list of host plants taken from the records of his department and for valuable suggestions.

The writer is also indebted to Dr. E. W. Berger, Entomologist, State Plant Board of Florida, for his valuable assistance and advice and for going over the list and making corrections, and to Prof. P. H. Rolfs, Director of the Florida Agricultural Experiment Station, for examining approximately the first half of the paper for errors in the botanical nomenclature.

Absinthium (see *Artemisia absinthium* L.).
Acacia spp. c, e, f, g, h, i, l, t, u.
Acacia armata h.
Acacias, Australian g.
Acacia decurrens h.
Acacia decurrens var. *mollis* Lindl. (see *A. molissima).*
Acacia, False (see *Robinia pseudacacia).*
Acacia floribunda (Sidney Golden Wattle, variety of) i.
Acacia Julibrissin Willd. (see *Albizzia Julibrissin* Durazz.).
Acacia latifolia i.
Acacia limnoeris i.
Acacia melanoxylon (Australian Blackwood) (Blackwood acacia) g.
Acacia molissima Willd. i.
Acacia Nemu (see *Albizzia Julibrissin* Durazz.).
Acacia ornata u.
Acacia, Yellow (see *Robinia pseudacacia).*
Acalypha spp. p, v.
Acer sp. (Maple).
Achras sapota L. (Sapodilla).
Achyranthes sp. (see *Iresine sp.)* t.
Albizzia Julibrissin Durazz. *(Acacia Julibrissin* Willd.) *(Acacia Nemu* Willd.) z.
Alfalfa (see *Medicago sativa)* c, l.
Alligator-tree (see *Liquidambar styraciflua* L.).
Almond, Dwarf Flowering e, i, l.
Almond, Flowering (see *Prunus triloba)* t.
Althaea officinalis t.
Amaranth (see *Amarantus sp.).*
Amarantus sp. (Amaranth) e, l.
Amarantus retroflexus (Beet-root) (Red-root) (Careless Weed) i.
Ambrosia sp. c, e.
Ambrosia psilostachya e, l.
American Elder (see *Sambucus canadensis).*
American Holly (see *Ilex opaca).*
Amorpha fruticosa (Bastard Indigo) s.

Anona u.
Antigonon leptopus (Rosa de Montana) (Mountain Rose) (San Miguelito) (Corallita) (Love's Chain) a.
Apple (see *Pyrus malus)* c, d, e, h, i, l, t.
Apricot (see *Prunus armeniaca)* c, d, i, l, t.
Aralia sp. w.
Aralia papyrifera (see *Tetrapanax papyriferum)* t.
Artemisia absinthium L. (Worm Wood) (Absinthium) b.
Artemisia ludoviciana (White Sage) (Western Mugwort) i, l.
Ascyrum sp. t.
Asparagus (see *Asparagus officinalis)* t.
Asparagus officinalis (Asparagus).
Aster t.
Aubergine (see *Solanum melongena* var. *esculentum).*
Australian acacias g.
Australian Blackwood (see *Acacia melanoxylon)* c, l.
Australian Silk Oak (see *Grevillea robusta).*
Australian Pine (see *Casuarina equisetifolia)* a.
Baccharis halimifolia t.
Bamboo, Wild (see *Smilax sp.).*
Banana (see *Musa sp.)* j.
Banyan, Wild (see *Ficus aurea).*
Bastard Indigo (see *Amorpha fruticosa).*
Bauhinia sp. (Mountain Ebony) (Orchid Tree).
Bay, Bull (see *Magnolia grandiflora).*
Bay *(Laurus nobilis)* w.
Bay, Rose (see *Nerium oleander).*
Bay, Sweet (see *Laurus nobilis)* t.
Bean t.
Bean, castor (see *Ricinus communis).*
Bearberry (see *Ilex decidua).*
Beefwood (see *Casuarina equisetifolia)* a.
Beet-root (see *Amarantus retroflexus).*
Beggarweed o.
Berberis sp. t.
Bermuda Grass (see *Cynodon dactylon) (Capriola dactylon,* Kuntze) c, d, l, t.
Bidens bipinnata L. (Spanish Needle) o.
Bidens pilosa i, l.
Bignonia sp. (Yellow Bignonia).
Bignonia, Yellow (see *Bignonia sp.)* t.
Bilsted (see *Liquidambar styraciflua* L.).
Birch, West Indian (see *Bursera Simaruba).*
Black Locust (see *Robina pseudacacia)* i.
Blackwood acacia (see *Acacia melonoxylon).*
Blackwood, Australian (see *Acacia melonoxylon).*
Blueberry (see *Vaccinum elliottii).*
"Blue-Gum" g.
Bottle Brush (see *Callistemon sp.)* g, l.
"Bottle-Brush" g.
Bougainvillea sp. a, g, l.
Bouvardia sp. t.
Box, Dwarf (see *Buxus sempervirens).*
Boxwood, c, l, t.
Bridal Wreath (see *Spirea cantoniensis)* i, l.
"Broom" u.
Broom, Spanish (see *Spartium junceum* L.).
Buddleia sp. t.
Bull Bay (see *Magnolia grandiflora).*
Bulnesia retano u.
Bumelia lanuginosa (Chittim Wood) t.
Bursera simaruba (Gumbo Limbo) (West Indian Birch) (Gum Elemi) a.
Buxus sempervirens (Dwarf Box).
Caladium t.
California Laurel (see *Umbellularia californica)* i.
California Pepper Tree (see *Schinus molle).*
Callicarpa americana (Spanish Mulberry).
Callistemon sp. (Bottle Brush).
Camphor (see *Cinnamomum camphora)* k, t.
Cane, Sugar (see *Saccharum officinarum* L.).
Canna sp. t.
Capriola dactylon, Kuntze. (see *Cynodon dactylon).*
Capsicum sp. (Pepper).
Careless Weed (see *Amarantus retroflexus).*
Carex spp. i, l.
Carica papaya (Papaya) (Pawpaw).
Carya pecan (Pecan).
Caryota urens (Toddy-palm) (Wine-palm) (Fish-Tail Palm) l, m, u.
Cassia marylandica (Wild Senna) t.
Castor Bean (see *Ricinus communis)* c, e, i, l.

Castor-oil plant (see *Ricinus communis*).
Casuarina equisetifolia (Australian Pine) a, l.
Casuarius g.
Catalonian (see *Jasminum grandiflorum*).
Cedar of Lebanon (see *Cedrus bibani*) c, l, t, u.
Cedrus bibani (Cedar of Lebanon).
Cedar sp. t.
Celtis sp. (Hackberry) (Sugar-berry) (Nettle Tree).
Cenchrus gracillimus (Sandspur) (Sand-bur) a.
Cereals u.
Chaetochloa sp. (Foxtail Grass).
Chenopodium album L. (Lamb's Quarters) (Pigweed).
Chenopodium murale L. i.
Chittim Wood (see *Bumelia lanuginosa*).
Chrysanthemum sp. c, l, t.
Chrysanthemum leucanthemum hybridum (Shasta Daisy).
Chrysolidocarpus lutescens l, m.
Cigar Plant (see *Cuphea tricolor*) t.
Cinnamomum camphora (Camphor).
Cinnamon vine (see *Dioscorea batatas*) t.
Citron (see *Citrus medica*) c, t.
Citrus (all species) a, d, t.
Citrus aurantium (Orange).
Citrus grandis (Grapefruit) (Pomelo).
Citrus limonia (Lemon).
Citrus medica (Citron) c.
Citrus sinensis (Orange).
Clematis sp. t.
Coco-grass (see *Cyperus rotundus*) t.
Cocoanut Palm (nuts only) (see *Cocos nucifera*) a, l.
Cocos nucifera (Cocoanut Palm).
Coffee Weed d.
Coleus a, l.
Common Mallow (see *Malva rotundifolia*).
Cone Flower (see *Rudbeckia sp.*).
Copper-leaf (see *Acalypha sp.*).
Corallita (see *Antigonon leptopus*).
Cork Elm (see *Ulmus racemosa*) i, l.
Corn (see *Zea mays*) t.
Cowpea (see *Vigina sp.*) b.
Crape Myrtle (see *Lagerstroemia indica*).
Crataegus sp. (Hawthorne) (Hawthorn).
Creeping Fig (see *Ficus pumila*).
Cuphea tricolor (Cigar Plant.
Cupressus sp. (Cypress).
Curly Dock (see *Rumex crispus*).
Cycas sp. t.
Cydonia oblonga (Quince).
Cynodon dactylon (Capriola dactylon, Kuntze.) (Bermuda Grass).
Cyperus rotundus (Coco-grass) (Nut-grass).
Cypress (see *Cupressus sp.*) c, f, h, i, l, t.
Daisy, Shasta (see *Chrysanthemum leucanthemum hybridum*) t.
Dandelion (see *Taraxacum officinale*) t.
Date Palm (see *Phoenix sp.*).
Dioscorea batatas (Cinnamon vine).
Dock, Curly (see *Rumex crispus*).
Dock, Yellow (see *Rumex Crispus*).
Dwarf Box (see *Buxus sempervirens*) i, l.
Dwarf Flowering Almond e, i, l.
Eagle Fern (see *Pteris aquilina* L.).
Ebony, Mountain (see *Bauhinia sp.*).
Eggplant (see *Solanum melongena* var. *esculentum*) t.
Elder, American (see *Sambucus canadensis*).
Elder, Sweet (see *Sambucus canadensis*).
Elderberry (see *Sambucus canadensis*) t.
Elm (see *Ulmus sp.*) t.
Elm, Cork (see *Ulmus racemosa*).
Elm, Rock (see *Ulmus racemosa*).
English Ivy (see *Hedera helix*) i, l.
English Walnut (see *Juglans regia*) c, l.
Epilobium coloratum (Willow Herb) i, l.
Erigeron canadensis i, l.
Escallonia bunda t.
Eucalyptus globulus (Blue-Gum).
Eucalyptus sp. i.
Euonymus t.
Euphorbia pulcherrima (Poinsettia).
False Acacia (see *Robinia pseudacacia*).
Fern (2 *spp.*) t.
Fern, Eagle (see *Pteris aquilina* L.).
Ficus aurea (Wild Banyan) a, l.
Ficus carica L. (Fig).
Ficus nitida (see *F. retusa*) t.
Ficus pumila (F. stipulata) (F. repens) (Creeping Fig).
Ficus repens (see *F. pumila*) t.
Ficus retusa.
Ficus stipulata (see *F. pumila*).
Fig (see *Ficus carica* L.) a, c, e, g, i, l, t.
Fig, Creeping (see *Ficus pumila*).
Firs u.

Fish Tail Palm (see *Caryota urens*) l.
Flamboyant (see *Poinciana regia*).
Flowering Almond (see *Prunus triloba*) c, l.
Foxtail Grass (see *Chaetochloa sp.*) a, l.
Fragaria sp. (Strawberry).
Fruit Trees u.
Furze (see *Ulex europaeus* L.) h.
Genista juncea (see *Spartium junceum* L.).
Geranium c, l, t.
Geranium, Ivy.
Geranium, Rose e, i, l.
Goldenrod (see *Solidago sp,*) c, l, t.
Golden-chain (see *Laburnum sp.*).
Golden Willow, g.
Gorse (see *Ulex europaeus* L.) h.
Grape (see *Vitis sp.*) a, c, e, i, l, t.
Grapefruit (see *Citrus grandis*) c.
Grass f, l.
Grass, Bermuda (see *Cynodon dactylon*).
Grass, Foxtail (see *Chaetochloa sp.*).
Grass, Johnson (see *Holcus halepense* L.).
Green Wattle (see *Acacia decurrens*).
Grevillea robusta (Silk Oak) (Australian Silk Oak) t.
Guava (see *Psidium guajava* L.).
Guinea squash (see *Solanum melongena* var. *esculentum*).
"Gum, Blue" (see *Eucalyptus globulus*).
Gum Elemi (see *Bursera simaruba*).
Gum, Red (see *Liquidambar styraciflua* L.).
Gum, Star-leaved (see *Liquidambar styraciflua*).
Gum, Sweet (see *Liquidambar styraciflua*) t.
Gumbo Limbo (see *Bursera simaruba*) a, l.
Hackberry (see *Celtis sp.*) c, l, t.
Hakea g.
Haw, Possum (see *Ilex decidua*).
Hawthorn (see *Crataegus sp.*) g.
Hawthorne (see *Crataegus sp.*) l.
Hedera helix (English Ivy).
Helianthus spp. (Sunflowers) a, t.
Hibiscus spp. n, t.
Holcus halepense L. (Johnson Grass) (*Sorghum halepense* (L.) Pers.).
Holly, American (see *Ilex opaca*).
Holly Oak (see *Quercus ilex* L.) c.
Holm Oak (see *Quercus ilex* L.).
Honeysuckle (see *Lonicera sp.*). i, t.
Hop (see *Humulus sp.*).
Humulus sp. (Hop) u.
Hymenoplea salsola u.
Ilex decidua (Possum Haw) (Bearberry) t.
Ilex kingerana a.
Ilex opaca (American Holly) t.
Impatiens sp. (Lady-Slipper) (Touch-me-not) t.
Indian Jassmine g.
Indigo, Bastard (see *Amorpha fruticosa*).
Inga pulcherrima t.
Ipomoea sp. (Japanese Morning Glory).
Iresine sp. (see *Achyranthes sp.*).
Iron-weed (see *Vernonia sp.*) c, l, t.
Italian Jasmine (see *Jasminum grandiflorum*).
"Ivy" u.
Ivy, English (see *Hedera helix*) t.
Ivy Geranium.
Japanese Morning Glory (see *Ipomoea sp.*).
Japanese Pittosporum (see *Pittosporum tobira*).
Japanese Plum (see *Prunus salicina*) t.
Japanese Yew (see *Podocarpus sp.*).
Jasminum grandiflorum (Italian Jasmine) (Royal Jasmine) (Spanish Jasmine) (Catalonian) t.
Jasmine, Italian (see *Jasminum grandiflorum*).
Jasmine, Royal (see *Jasminum grandiflorum*).
Jasmine, Spanish (see *Jasminum grandiflorum*).
Jassmine, Indian g.
Jew, Wandering (see *Zebrina pendula*).
Johnson Grass (*Holcus halepense* L.) (*Sorghum halepense* L.) t.
Juglans spp. (Walnuts).
Juglans regiae (English Walnut) (Persian Walnut).
Kangaroo Thorn (see *Acacia armata*).
Knotweed (see *Polygonum sp.*) c, l.
Kudzu (vine?) (see *Pueraria hirsuta*) t.
Laburnum sp. (Golden-chain) i.
Lady-Slipper (see *Impatiens sp.*) t.
Lady's Thumb (see *Polygonum persicaria*).
Lagerstroemia indica (Crape Myrtle).
Lamb's Quarters (see *Chenopodium album* L.) c, l, t.
Lantana sp. t.
Laurel (see *Laurus nobilis*) c, l, t.
Laurel, California (see *Umbellularia californica*).

Laurel Oak (see *Quercus laurifolia)* c.
Lauroceracus caroliniana u.
Laurus nobilis (Laurel) (Sweet Bay) c, u.
Laurestinus (see *Viburnum tinus* L.).
Laurustinus (see *Viburnum tinus* L.) g.
Leadwort (see *Plumbago sp.).*
Legume u.
Lemon (see *Citrus limonia)* c, f, h.
Leptomera acida u.
Lettuce, Wild (see *Letuca sp.)* t.
Letuca sp. (Wild Lettuce).
Ligustrum sp. (Privet).
Lime, Spanish (see *Melicocca bijuga* L.).
Liquidambar styraciflua L. (Sweet Gum) (Red Gum) (Bilsted) (Star-leaved Gum) (Alligator-tree).
Liriodendron tulipifera (Tulip-tree) (White Poplar) t.
Locust c, e, i, l, t.
Locust, Black (see *Robinia pseudacacia).*
Loggerhead Breast (see *Phyllanthus sp.)* a, l.
Lonicera sp. (Honeysuckle).
Love Entangle (see *Sedum acre).*
Love's Chain (see *Antigonon leptopus).*
Magnolia sp. c, e, l, t.
Magnolia grandiflora (Bull Bay) i.
Mallow, Common (see *Malva rotundifolia).*
Malva rotundifolia (Common Mallow) i, l.
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Marsh Mallow (see *Alhaea officinalis).*
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Melicocca bijuga (Spanish Lime).
Mentha piperita (Peppermint).
Mentha pyserifera.
Mentha spicata (Spearmint).
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Mimosa spp. t.
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Morning Glory, Japanese (see *Ipomoea sp.)* t.
Morus spp. (Mulberries).
Mountain Ebony (see *Bauhinia sp.)* r.
Mountain Rose (see *Antigonon leptopus).*
Mugwort, Western (see *Artemisia ludoviciana).*
Mulberries (see *Morus spp.)* d, l, t.
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Myrica cerifera (see *Morella cerifera)* b, d.
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Myrtle, Wax (see *Morella cerifera).*
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Nepeta sp. u.
Nerium lauriforme (see *N. oleander).*
Nerium oleander (Oleander) (Rose Bay) *(Nerium lauriforme).*
Nettle (see *Urtica sp.)* c, e, l, t.
Nettle Tree (see *Celtis sp.).*
Nightshade (see *Solanum nigrum)* c, e, l, t.
Nut-grass (see *Cyperus rotundus).*
Oak, Australian Silk (see *Grevillea robusta).*
Oak, Holly (see *Quercus ilex* L.) c.
Oak, Holm (see *Quercus ilex* L.).
Oak, Laurel (see *Quercus laurifolia).*
Oaks (see *Quercus spp.)* g, l, t.
Oak, White (see *Quercus alba* L.) c.
Old Man (see *Rosmarinus officinalis* L.).
Olea fragrans (see *Osmanthus fragrans).*
Olea sp. (Olive).
Oleander (see *Nerium Oleander)* i, l, t.
Olive (see *Olea sp.)* i.
Olive, Sweet (see *Osmanthus fragrans)* t.
Opopanax u.
Orange (see *Citrus sinensis)* or *(C. aurantium)* c, f, g, h, et al.
Orange, Trifoliate (see *Citrus trifoliata)* c.
Orchid Tree (see *Bauhinia sp.).*
Osmanthus fragrans (Sweet Olive) *(Olea fragrans).*
Palma christi (see *Ricinus communis).*
Palms t (5 spp.), u (1 sp.).
Palm, Cocoanut (see *Cocos nucifera).*
Palm, Date (see *Phoenix sp.)*
Palm, Fish Tail (see *Caryota urens).*
Panicum crus-galli i, l.
Papaya (see *Carica papaya)* n.
Papyrus antiquorum t.
Paradise Tree (see *Simaruba glauca)* a.

Paspalum spp. i, l.
Papaw (see *Carica papaya).*
Peach *(Prunus persica) (Persica vulgaris)* c, d, e, i, l, t.
Peacock Flower (see *Poinciana regia).*
Pear (see *Pyrus sp.)* c, d, i, l, t.
Pecan (see *Carya pecan)* c, e, l, t.
Pepper (see *Capsicum sp.)* c, e, i, l, t.
Peppermint (see *Mentha piperita)* l.
Pepper Tree, California (see *Schinus molle).*
Persian Walnut (see *Juglans regia).*
Persica vulgaris (Peach).
Peruvian Mastic-tree (see *Schinus molle* L.).
Phoenix sp. (Date Palm) v.
Photonia serrulata t.
Phyllanthus sp. (Loggerhead Breast).
Pigweed (see *Chenopodium album* L.) c, l, t.
Pine (see *Pinus sp.* or *spp.*?) c, d, f, h, l, t.
Pine, Australian (see *Casuarina equisetifolia).*
Pinus sp. or *spp.*? (Pine) c.
Pittospermum (?) f.
Pittosporum sp. c, g, l, t.
Pittosporum, Japanese (see *Pittosporum tobira).*
Pittosporum tobira (Tobira) (Japanese Pittosporum) i.
Plantago spp. (Plantain) i, l.
Plantain (see *Plantago spp.).*
Plum, Japanese (see *Prunus salicina).*
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Podocarpus sp. (Japanese Yew) t.
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Poinciana, Royal (see *Poinciana regia).*
Poinsettia (see *Euphorbia pulcherrima)* a, c, g, l, t.
Polygonum sp. e, l.
Polygonum persicaria (Lady's Thumb) i.
Polygonum sp. (Knotweed).
Pomegranate (see *Punica granatum)* a, c, e, i, l, t.
Pomelo (see *Citrus grandis).*
Poplar (2 spp.) (see *Populus spp.)* t.
Poplar, White (see *Liriodendron tulipifera).*
Populus sp. (Poplar) u.
Portulaca oleracea (Purslane) (Pusley) i, l.
Possum Haw (see *Ilex decidua).*
Potato (see *Solanum tuberosum)* c, e, i, l, t.
Potato, Spanish u.
Privet (see *Ligustrum sp.)* t.
Prosopis sp. u.
Prunus armeniaca (Apricot).
Prunus caroliniensis t.
Prunus persica (Peach) *(Persica vulgaris).*
Prunus salicina (Japanese Plum).
Prunus triloba ?.
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Psidium sp. x.
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Pueraria hirsuta (Kudzu) (vine ?).
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Zebrina pendula (Wandering Jew) *(Tradescantia fluminensis)*.

REFERENCES

The following references, when not otherwise indicated, refer to bulletins, letters, reports or specimens on file by the State Plant Board.

a. Watson, J. R., Annual Report, Florida Agricultural Experiment Station, 1915.
b. Wilson, C. E., Quarterly Bulletin, State Plant Board of Florida, Vol. II, No. 1. Plants found infested in Florida.
c. Essig, O. E., Insects of California. Monthly Bulletin, 2nd Edition.
d. Gossard, H. A., Bulletin 56, Fla. Agri. Exp. Sta. (Florida List).
e. Gossard, H. A., Bulletin 56, Fla. Agri. Exp. Sta. (California List).
f. Fernald, Mrs. M. E., Coccidae of the World, A catalogue of the.
g. Riley, Report, U. S. D. A. 1886, p. 471 (S. Africa).
h. Riley, Report, U. S. D. A. 1886, p. 472 (New Zealand).
i. Riley, Report, U. S. D. A. 1886, p. 472 (California).
j. Swanson, A. L.
k. Barber.
l. Wilson, C. E., Quarterly Bulletin, State Plant Board of Florida, Vol. II, No. 1. Plants liable to infestation.
m. Hume, H. H.
n. Chaffin, J.
o. Eikenberry.
p. Walker and Richmond.
q. Berger, E. W.

r. Baker, G. H.
s. Byrd, R. L.
t. Barber, E. R.
u. Sasscer, E. R.
v. Swanson and Thompson.
w. Brown, M. R.
x. Hall, J. E. B.
y. Campbell and Brown, M. R.
z. Berger and Bynum.

The volumes and catalogues consulted for the common and scientific names of host plants are given below.

The Standard Cyclopedia of Horticulture (by L. H. Bailey), Vols. I-VI, Edition of 1914.
Flora of the Southeastern United States (by J. K. Small), 1913.
Flora of the Florida Keys (by J. K. Small), 1913.
Shrubs of Florida (by J. K. Small), 1913.
Florida Trees (by J. K. Small), 1913.
Flora of Miami (by J. K. Small), 1913.
Catalogues of the Royal Palm Nurseries, Oneco, Fla.
Handbook, Bay State Nurseries, N. Abington, Mass.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*........................*Editor*

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DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING JUNE 30, 1919*.

Citrus grove trees inspected	1,821,704
Citrus nursery trees inspeced	13,390,251
Inspectors employed	156
New properties showing infection	1
Total properties showing active infection	2
Grove trees found infected	2
Nursery trees found infected	0
Counties in which active infections were found	1

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,726
Nursery trees found infected since May, 1914	342,254
Number properties infected to June 30, 1919	481
Properties declared no longer "danger centers"	475
Properties still classed as "infected" June 30, 1919	6

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*Compiled by Mr. Frank Stirling, General Inspector.

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to June 30, 1919:

1914		1915		1916		1917		1918		1919	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2	April	1
May	108	May	1042	May	338	May	52	May	1	May	1
June	160	June	772	June	450	June	45	June	10	June	0
July	275	July	651	July	349	July	39	July	0		
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0		
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0		
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0		
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0		
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0		

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING JUNE 30, 1919*

SHIPS AND VESSELS INSPECTED:		
From foreign ports	501	
From U. S. ports other than Florida	225	
From Florida ports	222	
Total		948
NUMBER OF PARCELS INSPECTED:		
Arriving by water:		
Passed	35645	
Treated and passed	110	
Returned to shipper	445	
Contraband destroyed	406	
Total		36606
Arriving by land—express, freight, wagon, etc.:		
Passed	1056¾	
Treated and passed	7	
Returned to shipper	10	
Contraband destroyed	22¼	
Total		1096
Arriving by mail:		
Passed	1141	
Treated and passed	44	
Returned to shipper	20	
Contraband destroyed	10	
Total		1215
TOTAL NUMBER OF PARCELS INSPECTED		38917

DISPOSITION OF PARCELS INSPECTED

TOTAL PARCELS PASSED	37842¾	
TOTAL PARCELS TREATED AND PASSED	161	
TOTAL PARCELS RETURNED TO SHIPPER	475	
CONTRABAND DESTROYED	438¼	
TOTAL		38917

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*Compiled by Dr. J. H. Montgomery, Quarantine Inspector

BEE DISEASE ERADICATION.—During the session of the Legislature, recently closed, a bill was introduced by Representative Thos. C. Ray, of Calhoun County, providing for the prevention and eradication of diseases of honey bees in Florida. This bill became a law and is now designated as Chapter 7938, Laws of Florida.

Honey bees are attacked at times by a number of different diseases, one of which, "American foul brood", is extremely destructive. In fact to the beekeeping industry this disease is as much of a terror as is citrus canker to the orange grower. The disease is caused by an organism, *Bacillus larvae*, which destroys the "brood" or larval stages of the bee, resulting in the colony being rapidly weakened and finally killed out entirely.

The Act mentioned, carrying with it an appropriation of $5,000 per annum, is of great importance to the beekeepers of Florida, for without protection against infectious diseases the bee and honey industries will not only fail to survive but, what is of even greater importance, future development along these lines will be made impossible.

From the standpoint of natural conditions, Florida is one of the best states in the Union for profitable beekeeping. The industry is only beginning to be developed and, fortunately, it appears that but little disease has thus far been introduced.

The execution of the new law is placed in the hands of the State Plant Board and work is already under way in eradicating American foul brood in two of the western Florida counties.

The Plant Commissioner is particularly anxious to have the names and addresses of all beekeepers in Florida and to have them report to him all cases of bee disease coming to their attention.

Copies of the bee disease act, together with rules and regulations made by the State Plant Board in connection therewith, can be secured by writing the Plant Board at Gainesville.

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State Plant Board of Florida

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THE EUROPEAN CORN BORER

Insect Established in New England and New York Regarded as Menace to the Corn Crop of the United States

WILMON NEWELL

What is regarded by entomologists as one of the most serious insect pests yet found in the United States has occupied an area of 1400 square miles near Boston, Mass., an area of about 200 square miles on Cape Cod and still another area of 300 square miles at Schenectady, New York. This insect is the European corn borer, *Pyrausta nubilalis* Hubner, and it threatens to do more damage, in the aggregate, than any pest with which the farmers or fruit growers of America have yet had to contend. Already the States of Massachusetts and New York have each expended nearly $100,000.00 in fighting it, the U. S. Department of Agriculture is using a Congressional appropriation of $250,000.00 for the same purpose, appropriated by Congress in August, 1919. The Department is asking for an additional appropriation of $500,000.00 and a conference of State Commissioners of Agriculture and Official Entomologists, held at Albany, N. Y., and Boston, Mass., on August 28th and 29th has recommended to Congress that $2,000,000.00 be appropriated at once to combat the pest, with the additional appropriation, later, of as many more millions of dollars as may be necessary.

OF IMPORTANCE TO FLORIDA

Although the European corn borer is, as yet, not known to occur in this country, outside of New England and New York State, its rate of spread during the past three seasons has been so alarming and the means by which it may be spread through commercial channels are so numerous that every state in the Union is vitally interested in the pest being eradicated, or at least confined to the territory it already occupies. It would undoubtedly do greater damage in Florida than it now does in the extreme northeastern states, as a consideration of the following information will show.

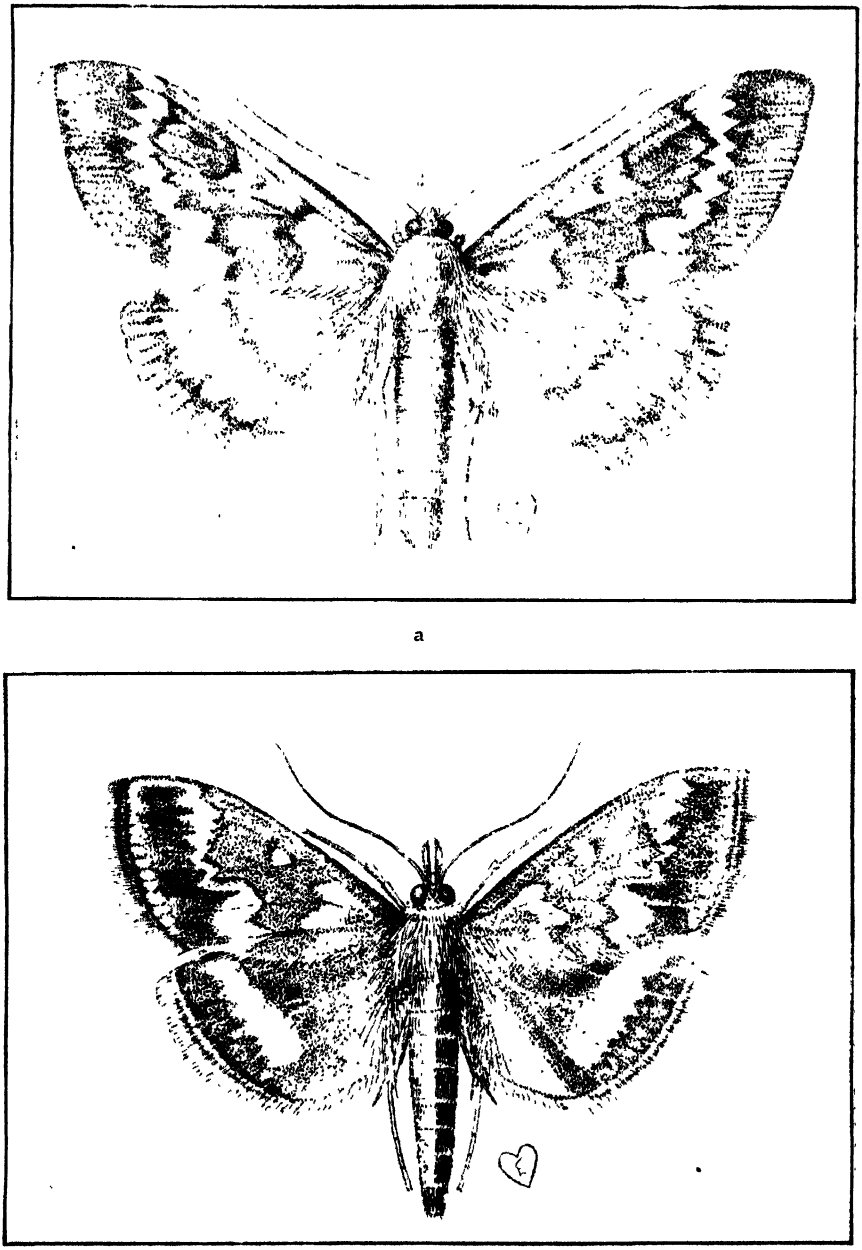


Fig. 1.—The European corn borer: a, female moth; b, male moth (After Caffrey, Farmers Bulletin 1046, U. S. Dept. of Agr.).

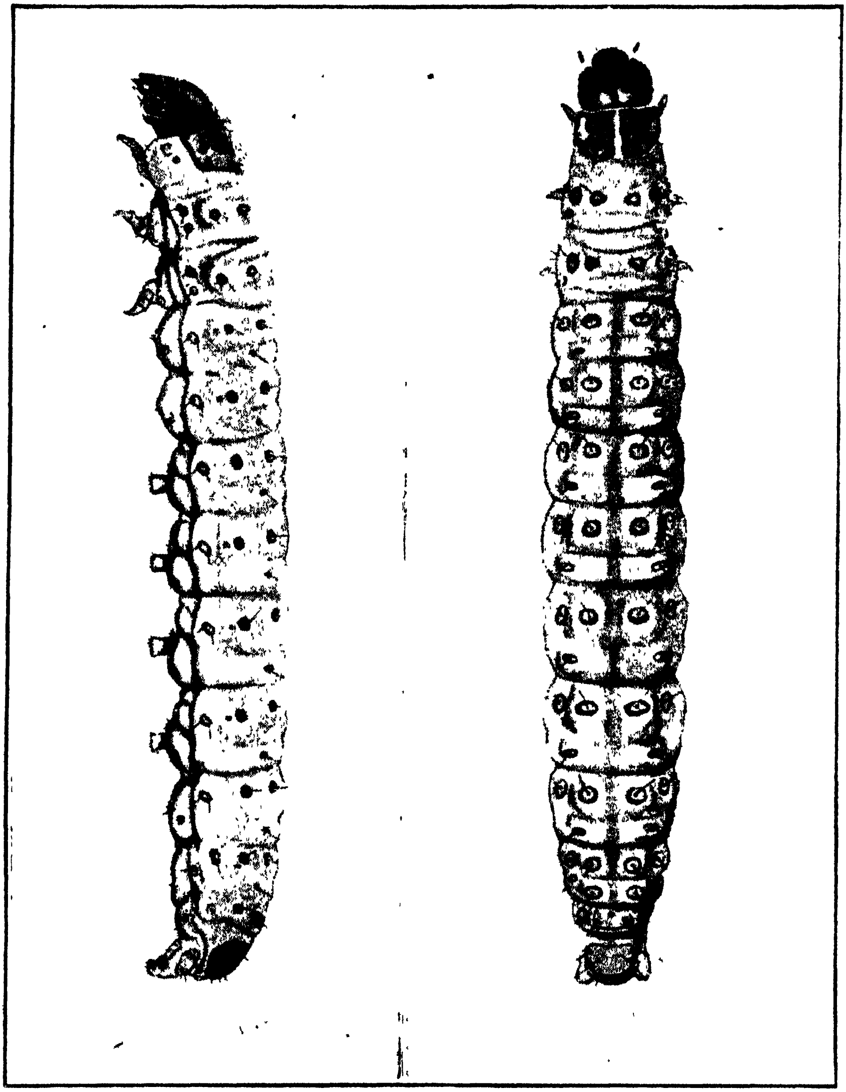
NATURE OF THE INSECT

The adult is a small, yellowish moth. The female deposits eggs on the leaves of corn and, in fact, of nearly all vegetation except forest and fruit trees. At the Bureau of Entomology Laboratory at Arlington, Mass., it has been found that the females lay an average of 385 eggs each and the maximum number deposited by one female was 777! The larvae, or borers, hatching from these eggs feed at first on the outside of the foliage or plant and then burrow into the stalk or stem. In the case of corn they tunnel their way through all parts of the plant except the small fibrous roots. Not content with burrowing through the stalk of the corn, the larvae eat their way through the stem of the ear into the heart of the cob and often through the side of the cob to the kernels. At other times they leave the inside of the stalks and crawl over the outside of the plant, cutting off the tassel or eating their way, through the shucks, into the ear. They may even feed for a time on grasses and then return to corn or other crops. While corn is the favorite food plant of the insect in Massachusetts it has been found to attack no less than 48 other plants, among which are the following: grasses of various kinds, asparagus, barley, beans, beets, cabbage, chrysanthemum, celery, goldenrod, grapevine, Hungarian millet, lettuce, oats, pigweed, pepper, potatoes, ragweed, Swiss chard, spinach, sunflower, thistle, tomatoes and wheat.

In Massachusetts there are two generations of the insect a year. Overwintering larvae transform to moths about the middle of May and these deposit eggs for the next generation of larvae. The moths from these begin to reach maturity during July and August and deposit eggs which hatch into larvae that, for the most part, do not complete their development before winter. They remain in the stalks of corn, in corn cobs and in the stems of various weeds and grasses until the following spring, when their development is completed.

RAPID SPREAD OF THE PEST IN NEW ENGLAND

The European corn borer was first found in the United States in the summer of 1917, near Boston, by Mr. S. C. Vinal, an agent of the Bureau of Entomology engaged in the study of truck crop insects. Identification of the insect showed it to be identical with the corn borer of Europe, a pest known to occur through central and southern Europe, west central and northern Asia, China, Japan and the Philippine Archipelago*. As the insect is known to attack hemp in Europe and as considerable hemp had been imported for use by cordage factories near Boston, it was assumed that the insect had become established through the importation of infested hemp.



a b

Fig. 2.—Full-grown larvae of the European corn borer: a, lateral view; b. dorsal view (After Caffrey, Farmers Bulletin 1046, U. S. Dept. of Agr.).

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*Bulletin 189, Massachusetts Agr. Exp. Station.

In 1917 the infested area near Boston covered about 100 square miles. By the latter part of 1918 this area had increased to 400 square miles and at the present writing covers not less than 1600 square miles. In addition to this area, another infestation, covering about 200 square miles, has been found on Cape Cod, the occurrence of the pest at this point undoubtedly having been due to the shipment of "roasting ears" from Boston to a resort hotel on the Cape. The insect was also discovered near Schenectady, New York, in January, 1919. This infested area covers about 300 square miles.

The adult moths are good fliers and are also blown considerable distances by the winds. This explains in part the rapid spread of the insect in localities where it has become established. The spread, however, is augmented greatly by the movement and shipment of green corn, ripe corn on the ear, corn fodder, straw and similar materials from the infested districts.

NO SATISFACTORY MEANS OF CONTROL

Owing to the rapid rate of increase of the insect and its habit of feeding inside of plants all ordinary measures for control of crop pests are ineffective. The most practical measure that suggests itself is of course the destruction during the winter of all corn stalks, weeds, etc., in which the larvae are hibernating and this is, in fact, the method being employed in the infested districts in the attempt to subdue the insect. However, in ordinary farm practice such a method would be prohibitive in its cost as, to be effective, it would involve the burning of all corn cobs, fodder, corn stalks and corn stubble, as well as all straw, hay, weeds and grass on the farm. It is also significant that in the infested area in the Mohawk Valley, in New York, where the State spent thousands of dollars last spring in the effort to destroy every particle of corn stubble and vegetation the pest is now as abundant as it probably was a year ago. Where similar methods have been employed in Massachusetts they have failed to bring about any appreciable decrease in the insects, although it is conceivable that without these measures the insects would be much more abundant now than they actually are.

Because the borer works for the most part inside of the plants, spraying with arsenical poisons, while destroying many larvae, cannot begin to offset the terrific rate of reproduction.

Plowing under of infested plants is also ineffective. Infested corn stalks buried last fall to a depth of one foot were found, when dug up the past spring, to contain healthy larvae and moths were able to issue through nine inches of dirt from infested stems that had been buried. A few parasites are known to attack the insect but they have not thus far brought about any perceptible diminution of the borers. The rate of increase of the

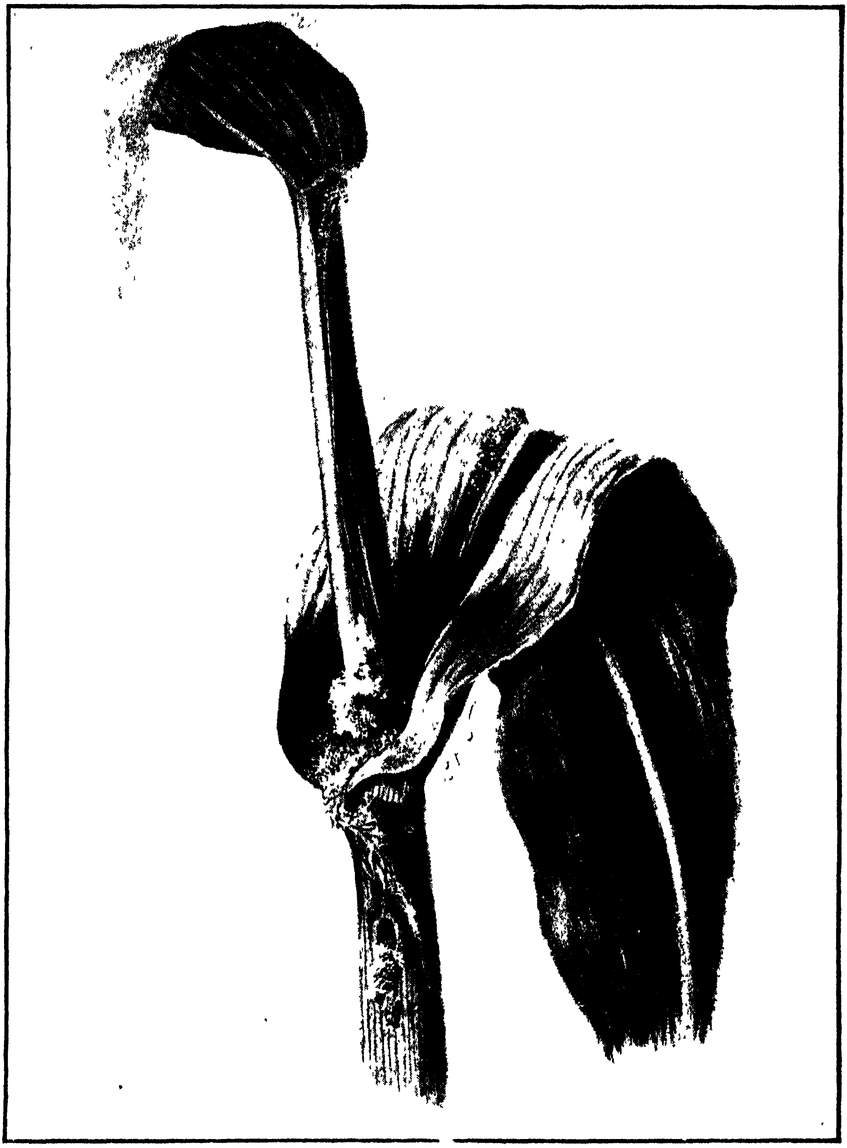

Fig. 3.—Typical injury to stalk of corn by larvae of the European corn borer, showing entrance to burrow of the larvae and extruded "frass" or refuse (After Caffrey, Farmers Bulletin 1046, U. S. Dept. of Agr.).

European corn borer is in fact so great that any natural or artificial control measure which destroys less than 98 per cent of each generation would have no effect upon the damage done by the insect. The progeny of one pair of moths can amount to 300,000 insects in a single season. The increase of the insect is therefore limited only by the amount of food which growing plants can provide for it and a large proportion of each generation could be destroyed without the damage to crops being in the least reduced.

DANGER TO THE SOUTH

There is nothing in the foreign distribution of the European corn borer, or in its habits, to indicate that it would be other than a most destructive insect in the warmer sections of the United States. There would undoubtedly be three or four generations here, as compared to two in Massachusetts. In addition, the insect would find a greater variety of plants here subject to its attack. For one thing it would doubtless find sugar cane as much to its liking as corn. This conclusion is reached because corn and cane are closely related, both being grasses and because many native insects of the South attack both corn and cane indiscriminately. In fact, nearly every corn infesting insect attacks cane and vice versa. The succulent and tender interior of sugar cane stems would afford ideal food for the borer and there is no telling, with several generations a year, how severely the borer would injure the cane crop.

The European corn borer has been found to attack cotton in Egypt. In Massachusetts it attacks, slightly, a number of vegetable crops and it is not impossible that under Florida climatic conditions it would prove an enemy of celery, tomatoes, beans, pepper or lettuce.

The possibility of this pest reaching Florida is more than a passing one. The larvae might be contained in corn fodder, corn on the ear or straw used as feed or bedding for livestock shipped from New England or New York to Florida points, they might be in celery, green corn, green string beans or other vegetables used on board vessels sailing direct from Boston to Florida ports, such as Jacksonville, in stems of such plants as chrysanthemums, grapevines, etc., shipped as nursery stock, in pieces of corn stalk, cobs or grain or weed stems contained in shipments of seed in bulk, in hay, grass or straw used as packing for crockery or glassware, or even in the stems of such cut flowers as chrysanthemums, gladiolas, dahlias, etc. shipped by New York and Boston florists to Florida during the tourist season.

The shipment of all nursery plants which are known to be hosts of the corn borer has already been prohibited from the "infested" areas by the Nursery Inspector of the State Plant Board, and all dangerous packing material with nursery stock from such areas has also been prohibited. However any quarantine measure which would effectively prevent the introduction of the insect in shipments of cut flowers, green vegetables, grain, seed, fodder, etc. would have to be very complicated, would cause more or less inconvenience to travelers and business men and for complete enforcement would require a larger quarantine force than the State Plant Board now has. At the same time, it is probable that the Board will, at its next meeting, adopt quarantine rules looking to the elimination of this danger as far as the circumstances permit.

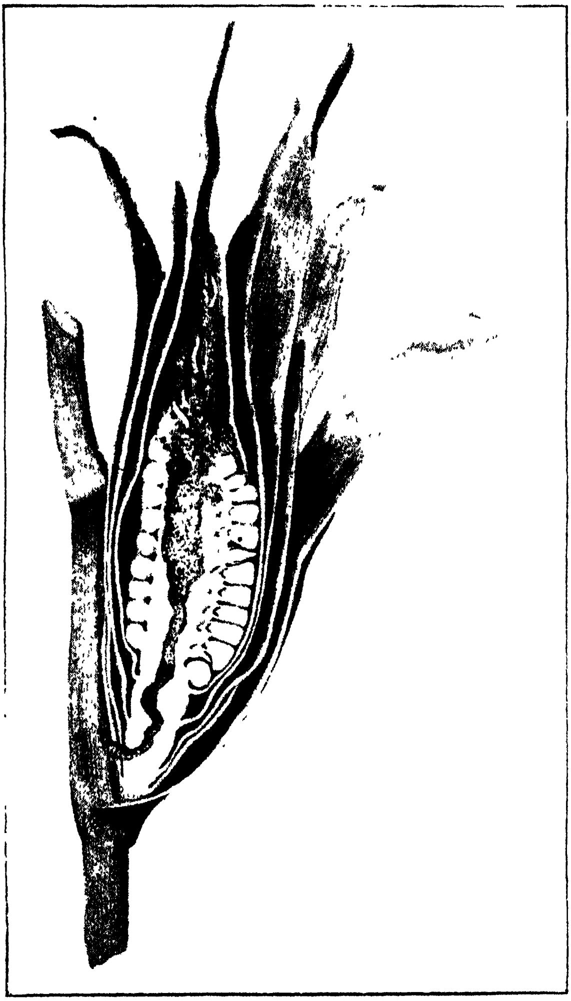

Fig. 1—Longitudinal section of ear of sweet corn damaged by the European corn borer, showing entrance of larvae, the stem and cob (After Caffrey, Farmers Bulletin 1046, U. S. Dept. of Agr.).

WHAT SHOULD BE DONE

The citizens of Florida can help protect the State against the introduction of this destructive insect. In the first place they should not have shipments made, from New England and New

York State, of nursery stock, cut flowers, seed in bulk (uncleaned seed), or vegetables. In the second place every farmer and trucker in Florida should keep a sharp lookout for the pest in his neighborhood. Any spotted "worm" or larva found within the stems of corn, either green or dried, should be regarded with suspicion and specimens immediately sent to the State Experiment Station or the State Plant Board at Gainesville for identification. As corn is the favorite host plant of the insect it is almost a certainty that the insect will be found in corn stalks almost immediately after its introduction into a community.

The problem is too big for the State Plant Board to handle alone. The vigilance and cooperation of all citizens is necessary if this pest is to be kept out of Florida, or eradicated if it should, by any chance, get in.

The information contained in this article was secured through the personal investigations of the writer in Massachusetts and New York during August and September, 1919, and is confirmed in all essentials by Bulletin 189 of the Massachusetts Experiment Station and Farmers Bulletin No. 1046 of the U. S. Dept. of Agriculture.

THE BEE DISEASE ERADICATION WORK OF THE STATE PLANT BOARD

Wilmon Newell

For many years Florida has been recognized by the beekeeping fraternity generally as being one of the best sections of the United States for bee and honey production. Not only do many sections of the State possess native plants which produce nectar in abundance, but the climatic conditions make possible the rearing of bees and queens for at least eight months of the year.

While beekeeping has been developed to a high state of perfection in a few counties, the State as a whole has been very backwards in recognizing the possibilities in this industry. Perhaps this has been due to the abundance of other opportunities seemingly more attractive to both newcomers and the older citizens. However, within the past two years interest in bees has been increasing very rapidly, as is evidenced by the receipt of many requests for information on the subject by the State Plant Board and the Agricultural Division of the University of Florida, more recently, by the organization of Boys' and Girls' Beekeeping Clubs under the direction of various County Agents.

Honey bees, like all other creatures, are subject to certain diseases. While most of these diseases, in the case of the honey bee, are not so severe as to cause destruction of the colonies and can for the most part be rather easily cured or controlled, one disease, "American foul brood", is exceedingly malignant. In fact, in its virulence it may well be compared to anthrax in cattle, glanders in horses or cholera in hogs. The disease is caused by a bacterium, *Bacillus larvae,* which affects only the brood or larvae of the bees. Every larva which becomes infected dies, hence the colony rapidly becomes weakened by reason of few or no bees reaching maturity and eventually the colony dies out entirely. Bees never recover from the disease and the malady cannot be cured by the use of drugs. It is therefore a disease where prevention and eradication constitute the most effective measure to take against it.

The future of the beekeeping industry in Florida is very largely dependent on whether this disease can be eradicated and further introductions of it prevented. If the State can be kept free from the disease there is no reason why Florida's honey production should not within a few years reach a valuation of one million dollars annually.

Fortunately, present information indicates that there is a comparatively small amount of the disease in Florida, that is, in comparison to its prevalence in some of the northern states. It is also fortunate that the last session of the State Legislature passed a bee disease act (Chapter 7938, Approved June 9, 1919), providing for quarantines to keep diseased bees out of the State and empowering the State Plant Board to take all necessary steps looking to eradication of bee diseases within the State. For the latter purpose an appropriation of $5,000.00 per annum for two years was made.

The Act referred to requires all colonies of bees, and second-hand beekeeping equipment, shipped into Florida to be accompanied by an official certificate of inspection, or by a special permit issued by the Plant Commissioner upon satisfactory evidence that the bees are free from danger of infection. The only exception is in the case of bees shipped without combs or honey—the so-called "pound packages". These can be shipped into the State without certificate or inspection as there is no danger of such bees transmitting American foul brood. This requirement of the law will be strictly enforced. It has been given wide publicity through various journals devoted to beekeeping and the general managers of all transportation companies operating in Florida have been given official notice concerning it. In addition, the various assistant quarantine inspectors of the Florida State Plant Board, located at all ports and principal junction points in the State, will be able to readily intercept any shipment of bees as to which these requirements have not been complied with. In fact, it is next to an impossibility for bees to be shipped into the State in violation of the law because of the thorough organization of the Board's quarantine service.

As the appropriation for the first fiscal year did not become available until July 1st, actual work in inspecting apiaries could not be commenced until after that date. At the July meeting of the Board Mr. C. E. Bartholomew of Orlando was appointed by the Board as Assistant to the Plant Commissioner in the bee disease eradication work. Mr. Bartholomew had charge, for several years, of the beekeeping experimental work in Iowa, was subsequently employed as beekeeping expert by the United States Department of Agriculture and in addition had had charge, in the West, of very large apiaries. The present Plant Commissioner is also experienced in this line of work as he had charge, for five years, of the bee disease eradication work in Texas.

At the July meeting of the Board it was also decided, as the appropriation was insufficient to take up apiary inspection work over the entire State, that attention should first be given to those areas where beekeeping investments were at their maximum or where there was reason for believing that American foul brood occurred.

The beekeeping area along the Apalachicola River and its tributaries, in the Counties of Franklin, Calhoun, Liberty, Gadsden and Jackson, was reported as having more or less infection by this disease. In this area the industry is highly developed, the beekeepers using the latest and most approved methods, the apiaries varying in size from forty to as high as two hundred colonies and the tupelo bloom affording a very reliable and satisfactory honey crop each spring. A rough estimate, based on figures supplied by local beekeepers, indicates that in the territory between Apalachicola and the Georgia-Florida line there are between 10,000 and 12,000 colonies and the annual production of Tupelo honey is probably not far from 1,000 barrels. Naturally, a territory capable of such honey production has long since been fully occupied by beekeepers and there is no room for more.

In fact, in some parts of this area there are already too many apiaries for profitable returns and in much of the tupelo section the beekeepers find it necessary to move their apiaries further north, into Georgia and Alabama, during the summer and autumn months in order for the bees to secure sufficient honey to subsist on.

Manifestly, American foul brood could cause enormous losses in this area, so thickly congested with bees, and it was decided to take up the inspection and eradication work there. The beekeepers of this area had been largely instrumental in securing the passage of the bee disease act and were naturally anxious that the danger confronting them should be dealt with as quickly as possible.

On July 23rd Mr. Bartholomew and the writer proceeded to Calhoun County. Inspections of apiaries in the vicinity of Wewahitchka and Dalkeith were begun immediately. Later, Mr. C. F. Glenn of Wewahitchka was appointed by the Board as District Apiary Inspector and in the latter part of the month and during August assisted in the inspections. The writer continued inspection work in that vicinity until August 5th and Mr. Bartholomew until August 18th. Mr. Glenn has continued the inspection work since that time.

Up to September 30th, approximately 3800 colonies in Calhoun and adjacent counties had been inspected, with the result that eighteen colonies had been found infected with American foul brood. These were distributed through four apiaries. With the owners' permission the bees, brood, honey and combs in all the infected colonies were destroyed by burning and the hive-bodies, covers and bottom boards disinfected with the burning oil spray. The lack of a sufficient honey flow did not make it practical to administer the so-called "shaking" treatment by which, under suitable conditions, the queen and bees can be removed from the infected material and the colony thereby "cured". It was also considered inadvisable to permit the diseased colonies to remain in existence, even for a short time, owing to the danger of the infection being carried to large apiaries in the neighborhood. To the present writing there have been no recurrences of the disease in these apiaries or those adjoining them, so there is good reason for believing that the "clean-up" in these apiaries was effective.

It should be stated in this connection that during June, just prior to the approval of the Bee Disease Act, a rather large apiary in Calhoun County was found by the owner to be infected with American foul brood. The owners of this apiary burned up all colonies in the apiary voluntarily and without compensation, for the protection of their fellow beekeepers.

During September inspection was commenced in Franklin County, particularly at Apalachicola and along the lower stretches of the Apalachicola River, along Jackson's Old River and in the Lake Wimico neighborhood. This work was done by Mr. Bartholomew, assisted by Mr. J. P. Anthony, of Apalachicola.

On the whole, the inspections thus far made in the Apalachicola River territory indicate that, while American foul brood has gained a foothold there, it has not become so firmly established that it cannot be eradicated by steady, careful work, particularly as the Plant Board is enjoying, in this undertaking, the practically universal co-operation of all the beekeepers.

The major portion of the current year's appropriation of $5,000.00 will be required for the eradication work in the area mentioned and until the disease is eradicated, or until at least all infections have been located and gotten under full control, it will not be possible for the Board to take up the eradication of bee diseases in other portions of Florida: although there are reasons for believing that American foul brood occurs in at least three other sections. Were the Board to attempt to spread its work over the entire State, with the appropriation available, nothing really worth while would be accomplished in any one section. It seems best, therefore, to clean up one area at a time, doing the work with the utmost thoroughness.

Until such time as the Plant Board can extend this work to other parts of the State all beekeepers should inform themselves regarding the nature of foul brood, learn its symptoms and be on the lookout for it, promptly reporting to the Board at Gainesville any suspicious cases. Bulletins of the United States Department of Agriculture describing the more common bee diseases, including American foul brood, and copies of the Bee Disease Act of Florida and the rules of the State Plant Board, may be had free by addressing the writer of this article at Gainesville, Florida.

The Plant Commissioner is desirous of having the name and address of every beekeeper in Forida, regardless of whether he owns one colony or one thousand and beekeepers will therefore confer a favor by writing him, giving at the same time the number of colonies owned.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*........*Editor*

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H. E. STEVENS	*Consulting Plant Pathologist*

Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING SEPTEMBER 30, 1919*.

Citrus grove trees inspected	1,027,316
Citrus nursery trees inspected	8,082,788
Inspectors employed	110
New properties showing infection	0
Total properties showing active infection	1
Grove trees found infected	1
Nursery trees found infected	0
Counties in which active infections were found	1

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,727
Nursery trees found infected since May, 1914	342,254
Number properties infected to September 30, 1919	481
Properties declared no longer "danger centers"	475
Properties still classed as "infected" September 30, 1919	6

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*Compiled by Frank Stirling, General Inspector.

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to September 30, 1919:

1914		1915		1916		1917		1918		1919	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2	April	1
May	108	May	1042	May	338	May	52	May	1	May	1
June	160	June	772	June	450	June	45	June	10	June	0
July	275	July	651	July	349	July	39	July	0	July	0
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0	Aug.	1
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0	Sept.	0
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0		
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0		
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0		

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING SEPTEMBER 30, 1919

Among the notable interceptions made during the Quarter were the following:

Black fly *(Aleurocanthus woglumi)* was intercepted on Spanish lime from The Bahamas.

An important scale-insect, *Aspidiotus coccotiphagus,* was intercepted on palm from Cuba and another important scale, *A. destructor,* was taken on palms from both Cuba and the Isle of Pines. *A. orientalis* on palm, *A. sacchari* on sugar cane, *Pseudischnaspis alienus* on guava and palm and *Vinsonia stellifera* on sapodilla were also taken in material from Cuba.

The seed-infesting Hymenopteron, *Bephrata cubensis,* was taken in soursop from Cuba.

SHIPS AND VESSELS INSPECTED:

From foreign ports	538	
From U. S. ports other than Florida	272	
From Florida ports	187	
Total		997

NUMBER OF PARCELS INSPECTED:

Arriving by water:		
Passed	53015	
Treated and passed	34503½	
Returned to shipper	401	
Contraband destroyed	429	
Total		88348½

Arriving by land: express, freight, wagon, etc.:			
Passed	1927¼		
Treated and passed	7		
Returned to shipper	24		
Contraband destroyed	28¾		
Total		1987	
Arriving by mail:			
Passed	148		
Treated and passed	9		
Returned to shipper	13		
Contraband destroyed	1		
Total		171	
Total number of parcels inspected			90506½
Number of parcels on hand pending determination as to final disposition	7		

DISPOSITION OF PARCELS INSPECTED

TOTAL NUMBER OF PARCELS PASSED	55090¼	
TOTAL NUMBER TREATED AND PASSED	34519½	
TOTAL NUMBER RETURNED TO SHIPPER	438	
TOTAL NUMBER CONTRABAND DESTROYED	458¾	
TOTAL NUMBER OF PARCELS INSPECTED		90506½

BEE DISEASE ERADICATION

REPORT ON INSPECTION AND ERADICATION WORK FOR THE QUARTER ENDING SEPTEMBER 30, 1919

Colonies of bees inspected	3,800
Colonies found infected with American foul brood	18
Number infected colonies destroyed, American foul brood	18
Number colonies found infected with European foul brood	3
Number of infected colonies treated, European foul brood	3
Number of colonies found infected with sacbrood	3

THE QUARTERLY BULLETIN

State Plant Board of Florida

Vol. IV JANUARY, 1920 No. 2

A CORRECTION

In our issue of October, 1919, page 3, in connection with the European corn borer, it was stated that this insect was first found in the United States in the summer of 1917 by Mr. S. C. Vinal, an agent of the Bureau of Entomology engaged in the study of truck crop insects. We have since learned that Mr. Vinal was not an agent of the Bureau of Entomology, but was assistant entomologist of the Massachusetts Agricultural Experiment Station, so that the latter institution is the one which should be credited with discovering this pest in America and giving warning of its dangerous nature.

THE SEMITROPICAL ARMY WORM*

E. W. BERGER

During the summer of 1918 a little heard-of pest made its appearance in destructive numbers in central and southern Florida. This insect, the semitropical army worm, had not previously been studied extensively and little was known concerning the best measures to use against it. During 1918 much information was gained regarding the pest and its control and it is deemed best to record here the essential facts concerning this outbreak in order that the information may be readily available for future use. While this army worm, in 1918, was primarily a pest of the castor bean it is, nevertheless, given to attacking various cultivated crops under favorable circumstances.

The first information** that insects might injure castor bean plantings came in a letter from Mr. Max Kisliuk, Jr., Emergency Entomologist, Bureau of Entomology, U. S. D. A., stationed at Miami, Fla., dated July 3, 1918. In it Mr. Kisliuk listed as of first importance a tingid (*Corythuca gossypii* Fabr.), a red spider, the semitropical army worm, a thrips, a fairly large shield bug and a leaf-hopper. The first information of a serious outbreak of army worms on castor beans at Vero, Fla., came in a telegram dated July 18, from Dr. Chittenden of the Bureau of Entomology, requesting assistance from the Plant Board, but

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Xylomyges eridania (Cramer).

**Worms on castor beans had, however, been observed by others at Sandy Beach, Palm Beach County, in late May and early June.

later wiring that Mr. J. E. Graf of his Division had been sent to Vero. On July 23rd, telegrams were received from the Chamber of Commerce, Helm & Walker, and Mr. J. F. Moznette, at Miami, all advising of a serious outbreak of the semitropical army worm in Dade County and asking for assistance from the State Plant Board. On July 24th, Mr. D. C. Gillett, of Tampa, wired that there was a serious outbreak of army worms in Hillsboro and Polk Counties. Upon receipt of the telegrams from Miami, the writer was at once ordered to Vero to assist in the control of the worms in any way possible. The writer arrived at Vero on the morning of July 25th and remained until the evening of August 3rd. District inspectors in charge of citrus inspection work on the East Coast were ordered by the Plant Commissioner to at once put their men to inspecting castor bean plantings and to assist in the control of the worms. Similarly, Plant Board men on the West Coast were ordered to assist in the control of the worms in Hillsboro and Polk Counties, and several men from the offices in Gainesville were ordered to the infested districts.

The source of information, besides the writer's own observations, upon which this paper is based, is principally a daily memorandum kept by the Plant Commissioner from July 18th to September 11th. In this memorandum summaries of reports from Plant Board inspectors, entomologists of the Bureau of Entomology, and others taking part in the work, made by letter, telegram and otherwise, are included. Principal mention, however, should be made of two typewritten reports by Mr. J. E. Graf, Bureau of Entomology, to Dr. F. H. Chittenden, his Chief in Washington, which have been freely used in this paper. A bulletin (1) by Chittenden and Russell is also referred to.

Unless otherwise stated, the castor bean plant is the host, or food plant, of the semitropical army worm under discussion.

It is desired also to make special mention here of courtesies shown the writer and others engaged in the army worm control work at Vero by Messrs. A. M. Hill, E. J. Wood, A. W. Young, of the Indian River Farms Company, and of Mr. Alfred Warren, County Agent for St. Lucie County, all of whom at one time or another furnished free transportation and otherwise assisted.

LOCALITIES INFESTED

For convenience, the localities infested will be listed under East Coast, Middle Florida, and West Florida. The successive

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1. F. H. Chittenden and H. M. Russell. The Semitropical Army Worm, Bulletin No. 66, Part V, Bur. Ent., U. S. D. A. (1909).

order in each group is arranged more or less according to the time reports were received from each place. In other words, the places first reported as infested are placed first in the list, and the last ones towards the last. It is not intended in this arrangement to indicate the order of infestation, altho the arrangement does more or less indicate that. The outbreak, according to the reports received, began about the 17th of July and ended about the 1st of September. It may be repeated here that notice of the outbreak at Vero on the East Coast was received on July 18th, of the outbreak in Hillsboro and Polk Counties on July 24th, and the first report from Kissimmee, Osceola County, on July 24th. Whether or not the semitropical army worm was the species present in all the localities listed cannot be stated positively, as specific identifications were not always made, and in some instances the fall army worm may have been present instead of the semitropical, or together with the latter.

East Coast—*Vero, Boynton, *Dade Co.**, between Delray and West Palm Beach, Palm City, White City, Ft. Pierce, Quay, Wabasso, Micco, Melbourne, Deer Park, Titusville, Cocoa, Merritts Island, New Smyrna, Holly Hill, Port Orange, Oak Hill, Bunnell and DeLand, *Sanford[a], Elliot Key, Eau Gallie, Daytona, Hastings, DeLeon Springs, *East Palatka.

Middle Florida.—[aa]Kissimmee, Polk County (Eagle Lake, Bartow, Lakeland, Mulberry, Haines City,* Ft. Meade, Galloway, Haskell, Kathleen, Eloise, Lucerne Park, Auburndale, Crooked Lake, Lake Wales, Lake Alfred, Loughman, Davenport, Lake Hamilton, Dundee), Bowling Green, Oxford, [b]Orlando, [b]Mt. Dora, [b]Tavares, Pinecastle, *Moorehaven†, Dade City, Bushnell, Sparr, Reddick, Hawthorne, *Gainesville, Macclenny, Ocala, Winter Haven, Arcadia, Winter Park, Fairbanks, Waldo, Grove Park, Rex, Alachua, Windsor, *Oviedo, Longwood, Inverness.

West Coast.—Hillsboro County (Seffner, *Plant City, Ruskin, Sydney, Valrico, Mango, Knights, Sulphur Springs, *Tampa, Brandon), Punta Gorda, Ft. Myers, Elfers, Sarasota, Ozona, Crystal Springs, Wimauma, Buckingham, Alva, Denaud, Pineola, Dunedin.

[a] Also Fall Army Worm (See 6th paragraph of final topic, Statement by J. R Watson).

[aa] Fall Army Worm (6th paragraph of final topic).

[b] See 3d and 4th paragraphs of final topic for species of worms present.

*Identified by Geo. B. Merrill, Assistant Entomologist.

**Identified by Max Kisliuk, Jr., and J. F. Moznette.

†Also Sweet Potato Caterpillar, or Cotton Cutworm (*Prodenia ornithogalli* Guen.).

INJURY TO CASTOR BEAN PLANTS

The outbreak of the worms in July was very threatening and it looked as tho almost everything in sight might be destroyed, at least by the next brood, but what with poisoning, collecting young broods and egg masses, effects of parasites and birds, the large brood anticipated in August did not materialize. Altho many egg masses and young broods appeared, these did not do much injury, apparently being further controlled by natural enemies.

All parts of the castor plants, as probably also of any other plants attacked, are eaten by the worms. The leaves, of course, are preferred, the young fruit spikes next; then the leaf petioles and the tips of the plants. The older worms that largely congregate in the daytime near the base of the plants very generally eat the bark off the plant there. Nearly mature spikes are not severely injured, the outer green covering only being eaten off.

Where castor plants were completely stripped it was apparent that many of them would die, but many, on the other hand, were putting out new growth, and indications were that they would continue to grow, and probably produce some beans unless killed by early frosts.

LOCALIZATION OF GREATEST INJURY

Injury to castor beans on the East Coast appears to have been greatest at Vero, and southward for perhaps 30 miles. There were few, if any, fields at Vero not infested, and actual destruction was estimated at 25 per cent, or about 100 acres. Several fields of 5 to 20 acres in size were wholly defoliated at the time the writer was at Vero, July 25th to August 3rd, inclusive.

Considering the amount of infestation by counties on the East Coast, one-fourth to one-third of the fields were reported infested in Dade County, but only one severely. In Broward County one-half were reported as lightly infested; two or three severely. In Palm Beach County, three-fourths of the fields were reported lightly infested, four or five severely. In St. Lucie County, in which Vero is located, nearly all fields were lightly infested, with perhaps seven or eight heavily infested. It will be noted here that the infestation gradually increased to the northward from Dade County. On the other hand, the infestation rapidly decreased northward from St. Lucie County, or Vero.

In Middle Florida, the heaviest infestation was in Polk County, probably at or near Ft. Meade, where several fields were reported in bad shape.

On the West Coast, Hillsboro County was the center of infestation. Generally speaking, it appears that the most severe infestations were confined to a belt extending somewhat irregularly across the State, indicated by Hillsboro, Polk and St. Lucie Counties, with Osceola County forming practically a gap in the belt; and that infestations to the northward and southward might have had their origin in this belt, adult moths of a previous brood migrating and spreading the infestation. That migration to the northward took place from this belt appears very probable, as the infestations in that direction generally appeared later, and were less severe than those in the belt. I am not so sure that migration took place to the southward from this belt, tho some may have taken place. The semitropical army worm being a native of Florida, we would expect that many local outbreaks could occur independently of each other, and that would be more particularly true to the southward, this species apparently being quite restricted in its northward range.

OTHER FOOD PLANTS

Besides the castor bean plant, cotton, of the cultivated plants, is probably next in favor as a food plant. A good-sized field at Vero had practically all of the lower bolls ruined by the worms, which attacked the immature bolls even when plenty of foliage was present, and also ate the bark near the base, where numbers of the large worms clustered. The blooms and squares were also freely eaten into. This field, however, produced some cotton, as the owners sprayed some and collected the egg masses and young broods when the advent of the large August infestation was anticipated.

Other cultivated plants observed, and arranged more or less in order of preference by the worms are: sweet potato, sunflower, Irish potato, velvet beans, okra, eggplant, pepper, oleander, beggarweed, avocado, peanuts, watermelon, cowpeas and citrus.

The following non-cultivated plants were observed to be eaten by the worms: careless-weed, poke-weed, willow, morning-glory, bloodroot, *Sonchus* sp., *Rumex* sp. Of these, careless-weed and pokeberry are favorite foods, and the infestation probably first spread from these to the cultivated plants. Several acres of careless-weed near Vero were completely defoliated, as were other growths of careless-weed wherever found. This also holds true for poke-weed.

Finally, it appears to be the broad-leaved and fleshy-leaved plants that are attacked, few of the grasses showing any injury. Mr. J. E. Graf, in copy of typewritten report from Vero to Dr. Chittenden, states that he "did not note any worms on corn, Milo maize or sugar-cane." He further states, "I found egg masses on careless-weed *(Amaranthus)*, Irish potato, cotton, castor bean, sweet potato and poke-weed."

Chittenden and Russell (1) list the following host plants for the semitropical army worm: tomato, potato, sweet potato, eggplant, pepper, okra, collards, cowpeas, poke-weed, spiny amaranth, a wild Solanum, castor bean, cabbage and carrots.

CONTROL

At the time the writer arrived at Vero, July 25th, Mr. J. E. Graf of the Bureau of Entomology, who had arrived approximately a week earlier, had made observations and carried on some control experiments. Mr. Graf later summarized his observations and experiments in a typewritten report to Dr. Chittenden, in which he indicated the control measures under four topics: (1) picking leaves with young broods or egg masses, (2) dusting with arsenicals, (3) spraying with arsenicals, and (4) using poisoned baits.

Picking Leaves.—While something can be accomplished by picking leaves thoroly infested with the larger worms, such a practice would largely result in defoliating the plants, and would be quite as serious as allowing the worms to defoliate them. The method, however, is recommended before the young broods have scattered from the leaf on which they hatch or before the egg masses have hatched. As Mr. Graf states, this method gives 100 per cent efficiency, except in so far as young broods or egg masses may be missed by the collectors. This method of control was in full swing in a hundred acre planting belonging to a Mr. J. S. Angstadt when the writer began his observations at Vero. It was found that two 14-year-old boys were able to cover approximately 10 acres each per day. In this instance the boys also collected many leaves having the larger worms upon them. The writer does not hesitate to state his belief that, but for the persistent and efficient work by the two boys, sons of the owner, later assisted by a number of Plant Board inspectors and by men sent by the Bureau of Entomology, the castor bean planting in question would have been far more severely injured.

Excellent results by children picking brood leaves were also obtained on a farm near Gainesville.

This same method, but directed principally against the egg masses, was later practiced in a cotton field in charge of Mr. E. J. Wood and owned by Mrs. A. W. Young. After the brood of worms in early July had practically ruined the bottom crop of cotton Mr. Wood conceived the idea of using small boys for collecting the egg masses and broods of young worms of the next brood. This was quite an easy matter for small boys, as they could readily view the under side of the foliage, the plants being tall and well developed. The same method was also employed by Mr. Wood on castor beans. Mr. A. L. Swanson reported that in the Conner's field at New Smyrna, one man picked 700 brood leaves from a measured acre in two hours.

Dusting with Arsenicals.—The pole and bag method so frequently recommended for distributing powdered poisons was found by Mr. Graf to be impracticable. This method consists in placing some of the poisoned dust in two porous sacks fastened to the ends of a pole. The dust is then shaken over two rows by tapping or shaking the pole, which is carried by a person or on horseback. The fact that the castor bean plants were of uneven growth and many of them too high to be conveniently passed over without wetting the sacks is the reason why this method could not be successfully used. It was found that using a dusting machine was the most practicable method of application. It seemed important, however, that the dusting be done when the plants were wet with dew in order to make it stick properly. This allowed rather too short a working time per day so that the method was not carried beyond the experimental stage at Vero.

On the West Coast, in Hillsboro and Polk Counties, however, dusting was the method mostly depended upon for reducing the worms. Larger machines were employed there and one observer reported from Bartow that powdered lead arsenate had killed from 85 to 90 per cent of the worms. From Dade County, again, dusting was reported as not satisfactory. It is believed, however, that poisoned dust, if applied liberally, is effective against the worms. The dusting may, of course, have to be repeated in case of showers washing it off or heavy winds blowing it away.

The dusting mixture generally employed consisted of one part powdered lead arsenate to four parts of hydrated or air-slaked lime. Hundreds of hand dusting machines, costing about $15.00 each, were employed in Hillsboro and Polk Counties and elsewhere. Many smaller machines in the hands of growers were also made use of. At Tampa, Mr. D. C. Gillett used a dough mixer, operated by an electric motor, for mixing the lead arsenate and lime for the growers. The capacity of the mixer was stated to be one ton per day.

Spraying with Arsenicals.—This method was practiced principally in the vicinity of Ft. Pierce and White City, several power sprayers ordinarily used for spraying citrus trees being available and promptly put to use by the castor bean growers. One and one-half pounds of powdered lead arsenate to fifty gallons of water had been recommended and this strength was generally used. It appeared that 125 to 175 gallons per acre were necessary. The results appeared to have been very satisfactory. A grower at Vero sprayed about 12 acres of castor beans with lead arsenate and Black Leaf 40, using a power potato sprayer. Three men could spray 3 to 4 acres per day at a cost of $25.00 per day. The addition of the Black Leaf 40 was perhaps unnecessary.

Spraying with small hand sprayers was tried at Vero on a small scale and no doubt did much to reduce the injury by the worms. Chittenden and Russell (1) found lead arsenate spray very effective.

Poisoned Bait.—This method was tried about the time the writer arrived at Vero. Mr. Graf later reported that this method was especially effective if the worms were jarred off by tapping the plants with a stick or giving them a quick knock with the hand.

While it has not been observed that the worms migrate anything like the other army worms, the larger worms do wander about a great deal over the ground as well as up and down the plants. From numerous experiments made at Vero the writer is of the opinion that baiting with poisoned mash is a very effective method, perhaps even the most effective method for destroying the worms in a badly infested field where the worms have reached the stage where they wander about.

The poisoned bran mash used by Mr. Graf and the writer consisted of 25 pounds rice bran and cotton seed meal, half and half, one pound Paris green, all sweetened with syrup, and the juice and ground-up pulp and rinds of five or six oranges. Mr. Graf thought the fruit might be unnecessary, and later experiments by the writer fully verified this. Other experiments in badly infested portions of the Angstadt field also indicated that the citrus fruit in the mash is not necessary.

Mr. K. E. Bragdon, working at Miami, also reported that poisoned baits were used there with some success. Alfalfa meal, shorts, etc., were used in place of bran.

Ditching.—This is a well known method of heading off other army worms and consists in plowing furrows away from the field to be protected. The efficacy of the furrow depends largely upon the soil turned over being finely powdered and dry. If it rains, another furrow may have to be plowed. It is not improbable that this method might at times be useful in checking the worms migrating away from badly infested areas. At all events, rather deep drainage ditches with deep sides and in some instances with water in the bottom were found to have collected large numbers of the worms either at the sides of the fields or in the ditches running thru the fields. This was particularly noticeable in a small field in which the ditches were fed with water from an artesian well. In fact, thousands of worms were drowned in the parts of the ditches where the water flowed. It is not believed, however, that ditches alone would be effective in controlling the worms as the migrating instinct appears not to be sufficiently strong to keep the worms going in any certain direction, for they seem to wander about rather indefinitely.

The particular method of control is dependent upon the stage of development of the worms in the field. If the worms are young, and before they have started to migrate from the parent leaf, hand-picking is a very efficient method.

Dusting and spraying with arsenicals are applicable under almost any condition, except the egg stage, and even then, as the poison would be present when the young worms began to eat. Dusting, of course, should cover not only the plants but the weeds and grass between the rows so that worms wandering about there would get the poison.

The poisoned bait is especially useful when the worms have begun to wander over the ground and from plant to plant.

Finally, the grower should use the method most available at the time that something should be done to protect the plants. In many instances some labor would be available for hand picking, and as this requires no machinery there could be hardly any excuse for not doing something by the use of this method. Quite the same thing holds true for the poisoned bait method, in case the worms have progressed to the wandering stage, no equipment except buckets, scales and box for mixing being necessary.

EXPERIMENTS

As previously stated, rather extensive baiting was done at Vero with and without citrus fruits in the mash and some without shaking the worms from the plants. It may be further stated that during the baiting experiments in the Angstadt field, little, if any, difference was noted in the effectiveness of the bait on areas where the worms were shaken from the bushes and other areas where they were not shaken, indicating that the worms travel about, probably principally during the night.

The mash used consisted of one-half cotton seed meal and one-half rice bran, poisoned with 1 pound of Paris green to 24 pounds, and sweetened with one-half dram saccharine, as other sweetening was scarce. The mash was broad-casted on the ground and the results good on plant and ground when examined 24 hours and 48 hours later.

Spraying experiments using one pound of Paris green to 50 gallons of water, or one and one-half pounds powdered lead arsenate, resulted in fair killing on the plants, but did not result in killing the worms under trash on the ground like the poisoned mash did.

NATURAL ENEMIES

Whether insect or bird, these appeared to be scarce at the beginning of the outbreaks, but became more and more in evidence later.

Insects.—In the report from Vero, dated July 28th, Mr. J. E. Graf has the following statement:

> "Two or three bugs and their nymphs fed readily on the worms, including the spined soldier bug. A *Calosoma* (probably *sayi)* fed on the larvae, and its larvae fed on worms and pupae, principally the latter. The large brown wasp Russell mentions was quite common as were tiger bettles, tho I did not see any of the latter feeding. Internal parasites were very scarce, a tachinid* being noted, and I saw a few cocoons of what is probably a Braconid."

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*Tachina flies, or tachinids, resemble houseflies, but are more hairy, and the young (maggots) develop inside of caterpillars.

At Fort Meade, the larva of a ground bettle *(Calosoma?)* was also observed by Plant Board inspectors devouring an army worm, and after being captured ate four or five more.

Later Mr. Graf reported Tachinids as more abundant at Brandon and Seffner in Hillsboro County. In some instances as many as seven eggs had been laid on a worm. In some spots he found 75 per cent of the worms parasitized, but thinks that it was on an average 50 per cent.

At Vero the writer particularly noted an increase of the Tachinids, noting as many as five eggs deposited on a worm; in some places approximately 50 per cent of the worms having Tachinid eggs upon them. A cocoon of the genus *Ophion* was collected by the writer among some pupae. The Spined Soldier Bug *(Alcaeorrhynchus grandis,* Dall.) was also frequently noticed by the writer at Vero, as also the large brown wasp. Egg masses were also at times found eaten, a fact also observed by Mr. Graf.

During the latter days of July, 27 army worm pupae were received from Miami. On August 11th, eleven internal parasites (Sarcophagidae†) had emerged from eleven of them. Neither did the remaining 16 pupae develop into moths, indicating that these 16 were either diseased or parasitized.

The writer believes that it was predaceous insects and parasites that finally headed off the large brood anticipated in August.

Chittenden and Russell (1) found 7 species of parasitic and 6 species of predaceous insects attacking the worms at Orlando in 1907.

Birds.—Birds undoubtedly became a factor in the control of the worms. The flocks of birds seen frequenting castor bean fields and also a cotton field at Vero were evidently intent on business. Inspectors in the fields repeatedly advised that the birds ate worms. Thus Mr. Clifford Stokes stated that he observed them sit on the branches and pick the worms from under the leaves. Others corroborated this and also saw the birds on the ground where they had congregated. Mr. E. J. Wood saw birds sit on the branches eating worms and then fly away with more worms in their beaks.

In a letter dated July 29, 1919, Mr. Wm. L. Benedict advised that birds were active in infested fields, especially between

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†The Sarcophagidae also resemble houseflies and are more or less hairy. The maggots live mostly in decaying flesh, but some are parasitic in the pupae of moths.

Tampa and Ft. Myers. Mr. J. E. Graf observed the following birds as apparently feeding on worms in a cotton field at Vero: Jackdaw, quail, meadow lark *(Saturnella neglecta)*, rice-bird and shrike *(Lanius ludosivianus)*.

BROODS

Summary of Life History Period.—According to information given by Chittenden & Russell (1), the egg stage extends over 4 to 6 days, the larval or worm stage 17 days, and the pupal or resting stage 9 days, a total of 31 days. They estimate, however, that on an average the life history period probably extends over 35 days, allowing several days for the egg-laying period of the moth, which is given as four days. While accurate observations intended to verify any of these facts have not been carried out by the writer, general observations on the part of others, as well as the writer, indicate that these periods as given by Messrs. Chittenden and Russell are approximately correct.

Number of Generations.—Chittenden & Russell indicate that there are four principal broods, with a possible fifth one. Whether the unusually large brood injuring castor beans during July was the third brood or the second one will probably never be definitely determined. Chittenden & Russell (1) indicate the appearance of the third brood at Orlando during the first part of August, 1907. As young broods began to appear about the first part of August this year, the presumption is that it was the corresponding brood as observed by Chittenden & Russell at Orlando, namely, the third one, and that the large brood of July was the second one. There are, however, some indications that the large July brood was already the third one, so that the young brood of worms that were observed coming out during the first part of August may really have been the fourth brood. As gleaned from notes made by Mr. Graf, Dr. Chittenden was also of the opinion that the July brood may have been the third one and not the second one. The fact, furthermore, that farmers at Vero observed pupae on May 11th while digging Irish potatoes, indicates to the writer that the July brood may have been the third one, assuming of course that the pupae observed by the farmers were those of the semitropical army worm. It is probably fair to assume that they were, as no other worms appeared in great abundance later.

Abundance of Worms.—During the latter part of July, while the writer was at Vero in company with Mr. Graf and others, 200 to 400 large worms were not infrequently counted on a single castor bean leaf in badly infested areas. Such an abundance of worms necessarily resulted in much injury to the plants unless they were promptly controlled. About the same time, after many of the worms had pupated in the soil beneath the plants, the writer and others frequently found as many as thirty to fifty pupae per square foot in castor bean fields and also in a cotton field. When the egg masses began to appear in the early part of August, it was not uncommon to find as many as two to four per medium size castor bean plant. Probably an average of one per plant occurred thruout the fields.

DISTRIBUTION AND PREVIOUS RECORDS

Chittenden and Russell (1) indicate that the semitropical army worm is also in Porto Rico, and lists Georgia, California, Texas, Central and South America and Brazil as parts of its range. It is apparently a native of the southeastern United States, and outbreaks may be expected in any of these states as well as the West Indian Islands. The fact of its being a native indicates that any outbreaks that may occur will be more or less localized and of short duration, like the outbreak of the past season. This is due to the fact that the insect has an abundance of natural enemies that soon control it.

According to the same bulletin, specimens of this insect were received at Washington on May 22, 1887, from Cocoanut Grove, Fla., at which place it was reported as very injurious to egg-plant. Apparently the most serious recent outbreak prior to 1918 occurred at Orlando, beginning May 14, 1907, at which place it was reported attacking all forms of garden truck. It was also reported about the same time at St. Augustine, the Manatee River section, and Dade City, Fla.

DESCRIPTION

The following description is copied verbatim from Bulletin No. 66, Part V, Bur. Ent., U. S. D. A., already referred to, except that several sentences not relevant to the purpose of this article have been omitted:

"*The moth.*—The adult or moth has a wing expanse of nearly 1½ inches (33-38mm); the fore-wings are dull gray, sprinkled and dotted with brownish and black scales forming a pattern as shown in figure 4 *d.* There is considerable variability in these markings, some individuals having a strongly marked reniform spot, a very prominent blackish posterior marginal line, and a similar black line on the latero-posterior margin. Individuals also occur in which there is a straight, broad, jet-black dash or band beginning at the middle of the fore-wing and extending to the lateral margin. This is the *nigrofascia* of Hulst. The hind-wings are pearly white above, this pearly luster being still stronger below. The body is brownish gray and the antennae are yellowing brown. . . .

"*The eggs.*—The eggs are deposited in irregular masses, as shown in figure 4 *a,* closely placed together, sometimes in two layers and covered with whitish down, from the body of the female. They are distinctly green when first deposited and have the appearance illustrated at *b* and *c.* . . .

"*The larva.*— . . . The ground color is dark grayish in pale individuals and nearly black in the dark forms. These latter, especially when approaching maturity in the penultimate stage, are sometimes so dark as to resemble Mamestra. The body is ornamented with a narrow, slightly interrupted, median yellow longitudinal dorsal stripe, a similar slightly wider dorso-median stripe, and a wide and brighter yellow substigmatal stripe, which becomes obscured in the thoracic segments of the penultimate stage. In the very dark forms the triangular velvety dorsal spots characteristic of the genus can scarcely be seen, and in the paler forms they are seldom as distinct as in the other two species. When full-grown the larva measures about an inch and a fourth to an inch and a half in length (25-37mm), and the width varies from one-fourth of an inch to a little larger. The head measures nearly 2.5mm.

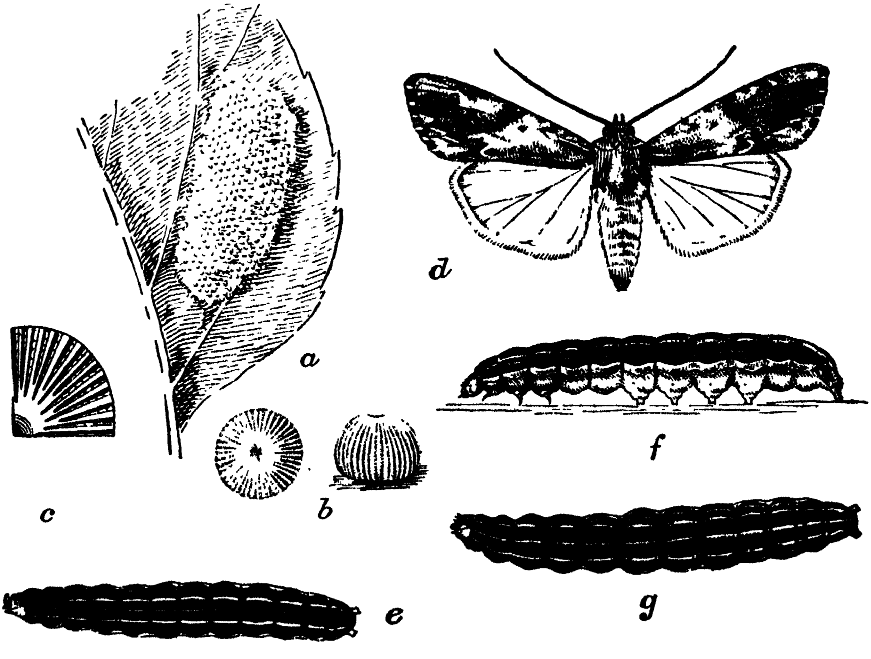

Figure 4.—The Semitropical Army Worm, *Xylomyges eridania* (Cramer): **a,** egg-mass on leaf; **b,** egg, much enlarged, showing lateral view at right and top at left; **c,** section of egg; **d,** moth; **e,** dark form of larva nearly grown; **f, g,** larva, full-grown. **a, d-g,** enlarged; **b,** highly magnified; **c.** more magnified. (From Bull. 66, Part V, Bureau of Entomology, U. S. Dept. Agriculture.)

"The mature larva is illustrated at *f* and *g* of figure 4 and a dark form nearly grown at *e.*

"*The pupa.*— . . . The head and abdomen are well rounded. The color is mahogany-brown, with the head, spiracles and anterior edges of the abdominal segments darker. The surface is smooth and shining, with the anterior edges of the abdominal segments finely punctured. The anal segment terminates in a two-spined cremaster-like process. Length, 16-18 mm; width, 5-6mm; length of head to end of the wing-cases, 10mm."

TRAP LIGHT EXPERIMENT*

Before leaving Vero in August, the writer, assisted by several of the other men on the army worm work, had the opportunity to set a trap light in a cotton field severely injured by the worms. The light consisted of a two-burner Wellsbach mantle lamp, burning gasoline, such as is frequently used for lighting stores and other buildings. The light is intensely bright. The lamp was set on a block of wood, inside a large galvanized iron tub, in the bottom of which about two inches of water with some kerosene had been placed. The whole was elevated on top of two barrels, or approximately 8 to 9 feet above ground, about 80 feet from the end of the field. The outfit was put in operation about 9:00 P. M., and allowed to burn until several hours after daylight.

The following insects and numbers were found in the tub the next morning: 102 moths of the semitropical army worm; 454 weevils; 10 Carabids, or ground beetles; 9 spined soldier bugs *(Alcaeorrhynchus grandis,* Dall.) ; 6 12-spotted cucumber beetles; 21 Diptera, or flies; 3 Ichneumons; 16 blister beetles and 46 cockroaches.

It is apparent from this that the number of adult moths of the semitropical army worm caught by the light can hardly be considered sufficient to indicate that trap lights have any real practical value in the control of this pest.

Of the 102 moths, Mr. E. K. Bynum, temporary assistant, found 80 to be males, 6 full of eggs, 6 half spent and 10 wholly spent, or without eggs.

OTHER CATERPILLARS

The common corn ear worm, also known as tomato worm and cotton boll worm *(Chloridea obsoleta,* Fab.) was probably present in most fields and was occasionally observed cutting round holes in the castor bean pods. This, of course, is a very common insect, and one would naturally expect to find it, provided, of course, that it had a taste for castor bean pods, which it has. The semitropical army worm does not make the clean-cut holes into the pods that the boll worm does.

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*In conducting this experiment, the writer desires to make special mention of Mr. A. E. Booth of the Sweet Potato Weevil Investigations conducted by the Bureau of Entomology, U. S. D. A., in Florida, who had been sent to Vero to assist in the army worm control work. Mr. Booth not only assisted in getting the outfit ready, but afterwards dried, sorted and counted the insects caught, as previously listed.

The pink corn worm *(Pyroderces rileyi,* Wals.) is also apparently generally distributed thruout the castor bean sections of Florida, but was especially noted on material received from Boynton, Vero and Ft. Meade. The probability is that this little caterpillar is a scavenger, feeding upon dying and dead material, particularly among the staminate blossoms, rather than attacking the live pods.

The sweet potato caterpillar *(Prodenia ornithogalli,* Guen.) was reported from Moore Haven, altho the semitropical army worm was in all probability also present there.

The fall army worm *(Laphygma frugiperda,* S. and A.) was also identified as present in several localities, altho it undoubtedly was of wider distribution than here indicated. It was definitely reported by Mr. J. C. Goodwin as present at Ft. Meade. It had previously occurred in considerable numbers on the University campus and to the north of Gainesville about July 13th. In two properties visited, the owners applied zinc arsenite and calcium arsenate, 1 to 4 of hydrated or air-slaked lime, as recommended by the Plant Board. The poisons were applied with a small dusting machine. While one owner had been successful in largely heading off the worms by plowing furrows, he also used some poison to kill the worms that had already gotten past. Two days later, both owners reported that each kind of poison had effectively killed the worms. The infestations occurred in two corn fields and grass lots. A near-by cotton field was threatened, and already slightly infested when the property was visited. On another property where no effort to check the worms was made, a small field was reported as completely ruined. An outbreak of what appears to be the same worm was also reported on grass from Lake Helen, Fla. Professor J. R. Watson, Entomologist of the Experiment Station, further advises that the fall army worm occurred all over the State during July, and that he received specimens from Kissimmee to Jackson County.

MEN EMPLOYED

Between 150 and 160 of the men regularly employed by the Plant Board at one time or another assisted in the control of this

outbreak of the semitropical army worm. Also not less than 10 men from the Bureau of Entomology and three from the Bureau of Plant Industry, both U. S. D. A., were temporarily transferred to the worm work. Several of the County Demonstration Agents and several men from the U. S. Signal Corps also assisted.

STATEMENT BY J. R. WATSON*

"In accordance with your request I am giving you a brief report of our experience with caterpillars on castor beans during the past summer.

"The first intimation of trouble we had from caterpillars on this crop other than cut worms was in late May when Prof. H. E. Stevens brought in some castor beans which he had raised on the Station grounds. The leaves were heavily infested with very young caterpillars and we fed these in the laboratory for some time until they were large enough so we could identify them. They seemed to be the common sweet potato caterpillar, *Prodenia ornithogalli,* and we made no further attempt to raise them. It is quite possible, however, that they might have been the semitropical army worm. This caterpillar looks very much like it in the early stages, and in some cases it is very difficult to tell which you have.

"During the last week in July we answered an urgent call to the central part of the peninsula where caterpillars were damaging castor beans. We visited Tavares, Mount Dora, Orlando and Sanford. In some fields in these places the caterpillars were doing considerable damage and seriously threatened the crop. The worst infestation was at Mount Dora.

"The caterpillars which we brought home with us and raised to maturity were either the ordinary sweet potato caterpillar, *Prodenia ornithogalli,* or the fall army worm, *Laphygma frugiperda.* It is quite possible that the semitropical army worm was in the fields too as in many cases it is difficult to distinguish the caterpillars of these two species, particularly when they are young. The moths, however, are easily told apart and there is no doubt of identification.

"The growers in the worst infested fields in Mount Dora were fully alive to the dangers of the insects and took measures to control them by dusting with lead arsenate.

"At Sanford we saw neither the Prodenia or Xylomyges, but there had been a heavy infestation of fall army worn *(Laphygma frugiperda).* These attack chiefly grass as a rule, but there had been some damage to cotton and castor beans. In passing, I might state that this species was at that time very abundant over most of Florida, at least the northern half of the State. The farthest south from which we received specimens was from Kissimmee where it was stated that they were damaging castor beans.

"The last seen of the semitropical army worm in Gainesville was last October when a nearly full grown caterpillar was found. In September, there were quite a number of young in this field, but they disappeared without causing any great amount of damage. In one case a blackbird was seen to carry off some of them. It is possible that this was the cause of the disappearance of the entire brood.

"In the worst infested corner the author easily controlled a colony by the Kansas bait. This was used very successfully against the fall army worm on July 18th in a field of crab grass near Gainesville. Last year we found it to be the best remedy for the sweet potato caterpillar.

"It is the writer's opinion that where beans are not too tall the Kansas bait is fully as efficient as dusting and much easier and quicker to apply. Where the plants are tall, however, it is difficult to get the bait distributed over the plants. Whether the bait thrown over the ground at the base of the plants will do the work, the writer cannot say as he has had no experience.

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*Entomologist Florida Agricultural Experiment Station.

"An insect which was mixed with the army worms more or less and doing a type of injury which might be easily confused with it was the corn ear worm, *Chloridea obsoleta.* It worked in its characteristic manner just as in corn, tomatoes, or cotton bolls by digging into the interior. It was feared at one time that this type of injury would increase as the season advanced, but apparently it did not. Evidently the castor bean is not one of the preferred hosts of *Chloridea.*

"You will be interested in knowing that on November 2, 1914, we received complaint of an outbreak of the semitropical army worm at Vero. Vero evidently seems to be a part of the State in which this caterpillar finds conditions favorable."

THE YAM WEEVIL

(*Paleopus dioscoreae,* Pierce)*

GEO. B. MERRILL

An interception of dangerous material worthy of special mention was made on September 14, 1919, at Key West, Florida, by Assistant Quarantine Inspectors Harold Mowry, Emil L. Gehry and L. Russell Warner.

A passenger en route to Florida from Kingston, Jamaica, via Havana, Cuba, brought along a Yam (*Dioscorea* sp.) from Jamaica which was included with her baggage. This yam was discovered and upon inspection, was found to be infested with some small yellowish white larvae. These were referred to the Entomological Department of the State Plant Board at Gainesville and on September 16 were placed in a breeding jar. On October 4, one adult had emerged. On November 7, three live and three dead adults were obtained as well as one pupa. They were identified by the writer as *Paleopus dioscoreae* Pierce.

Considering the number of weevils reared from the small portion of Yam sent in, it would seem that this weevil is one that would occasion much damage and loss to yams and possibly sweet potatoes, more especially in that part of Florida in which the conditions are of a more or less tropical or subtropical nature. Again, the host of this weevil in Jamaica, its native home, insofar as we are aware, is given as the Yam (*Dioscorea batatas*). This yam is known to be grown as far north as New York State. In this connection a serious question is presented. Might not this

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*Pierce, W. D. Weevils which affect Irish Potato, Sweet Potato and Yam. JOURNAL OF AGRICULTURAL RESEARCH, Vol. XII, No. 9, p. 611. 1918.

insect, like others of our undesired and introduced insects, adapt itself to a climate other than that of its tropical home?

The description of the Yam Weevil *(Paleopus dioscoreae)* as given by Dr. Pierce is as follows:

Adult: "Length 4.5 mm., breadth 1.75 mm. Piceous black, with reddish brown appendages. It is sparsely clad with dark brown or whitish oblong decumbent scales and erect, longer truncate scales of variable color. The punctuation is very coarse.

"Head smooth, beak separated from head by strong transverse constriction. Beak longitudinally five-striate and bristling in basal half with erect brown scales; apical half smoother, with confluent punctures and flat scales. Scrobes beginning beyond middle, diagonal, reaching eyes beneath. Eyes lateral, separated by width of beak, covered when at rest by pronotal lobes. Antennal funicle seven-jointed, first joint a little longer than second. Prothorax broad, depressed, convexly rounded on sides, bisinuate at base, lobed over eyes, truncate at apex which is about half as wide as base; median line broadly elevated; punctuation very coarse. Elytra 10-striate, the tenth striae abbreviated; strial punctures large, rounded, well separated, and setigerous; interspaces not wider than striae, clad with a single row of erect squamose setae of variable color. Scutellum indistinct. Elytra broader at base than thorax; with distinct humeri.

"Sternal canal deep, sharply margined, limited by a cup-like depression of the mesosternum. Posterior coxae very broadly separated. Metasternum at middle as long as first abdominal segment behind coxae. Intercoxal piece of first abdominal segment angulate at middle. Second segment not as long as third and fourth together.

"Femora dentate and canaliculate beneath. Tibiae curved at base, strongly hooked at the apex. Tarsal claws simple."

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING DECEMBER 31, 1919

Citrus grove trees inspected	1,565,201
Citrus nursery trees inspected	9,490,287
Inspectors employed	107
New properties showing infection	0
Total properties showing active infection	0
Grove trees found infected	0
Nursery trees found infected	0
Counties in which active infections were found	0

GENERAL SUMMARY

Florida counties in which canker has been found	**22**
Grove trees found infected since May, 1914	**13,727**
Nursery trees found infected since May, 1914	**342,254**
Number properties infected to December 31, 1919	**481**
Properties declared no longer "danger centers"	**479**
Properties still classed as "infected" December 31, 1919	**2**

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to December 31, 1919:

1914		1915		1916		1917		1918		1919	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1
		Apr.	408	Apr.	49	Apr.	169	Apr.	2	April	1
May	108	May	1042	May	338	May	52	May	1	May	1
June	160	June	772	June	450	June	45	June	10	June	0
July	275	July	651	July	349	July	39	July	0	July	0
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0	Aug.	1
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0	Sept.	0
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0	Oct.	0
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0	Nov.	0
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0	Dec.	0

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING DECEMBER 31, 1919

During this quarter the destructive scale, *Aspidiotus destructor* Sign., was again in evidence, having been intercepted five times in shipments from Cuba; in four instances on palms and in one instance on castor bean. Another scale-insect, *Pseudischnaspis alienus* Newst., was twice intercepted in shipments from Cuba, once on Caladium and once on Jasmine.

A very important interception was that of the yam weevil, *Palaeopus dioscoreae* Pierce, in yams from Jamaica.

Other important agricultural pests prevented entry into the State were a scale-insect, *Lepidosaphes alba* Ckll., infesting cassava from The Bahamas and the sugar-cane mealy bug, *Pseudococcus sacchari* Ckll., on sugar cane from Cuba.*

SHIPS AND VESSELS INSPECTED:

From foreign ports	620	
From U. S. ports other than Florida	340	
From Florida ports	222	
Total		1182

NUMBER OF PARCELS INSPECTED:

Arriving by water:

Passed	21202½	
Treated and passed	3269	
Returned to shipper	347	
Contraband destroyed	293½	
Total		25112

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*In our last Quarterly Report it was stated that *Vinsonia stellifera* on sapodilla was taken in material arriving from Cuba. An error was made in giving Cuba as the point of origin of this shipment as it, in fact, came from Nassau, Bahamas.

Arriving by land: express, freight, wagon, etc.:			
Passed	651¼		
Treated and passed	55		
Returned to shipper	106		
Contraband destroyed	273¾		
Total		1086	
Arriving by mail:			
Passed	627		
Treated and passed	25		
Returned to shipper	15		
Contraband destroyed	6		
Total		673	
Grand Total of Parcels Inspected			26,871
Number of parcels on hand pending determination as to final disposition	126		
TOTAL NUMBER OF PARCELS PASSED		22480¾	
TOTAL NUMBER TREATED AND PASSED		3349	
TOTAL NUMBER RETURNED TO SHIPPER		468	
TOTAL NUMBER CONTRABAND DESTROYED		573¼	
GRAND TOTAL OF PARCELS INSPECTED			26,871

BEE DISEASE ERADICATION

REPORT ON INSPECTION AND ERADICATION WORK FOR THE QUARTER ENDING DECEMBER 31, 1919

Number of apiaries inspected	72
Number of apiaries infected with American foul brood	10
Number of colonies inspected	3,905
Number of colonies infected with American foul brood	36
Number of colonies destroyed American foul brood	36
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	0
Number of colonies treated, European foul brood	0
Number of colonies infected with sacbrood	0

GENERAL SUMMARY

Number of apiaries inspected since July 1, 1919	151
Number of apiaries infected with American foul brood	16
Number of colonies inspected since July 1, 1919	7,705
Number of colonies infected with American foul brood	54
Number of colonies destroyed, American foul brood	54
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	3
Number of colonies treated, European foul brood	3
Number of colonies infected with sacbrood	3

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL. WITH SPECIAL REFERENCE TO THE PREVENTION. CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*..........*Editor*

ASSOCIATE EDITORS.

E. W. BERGER..........*Entomologist*
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FRANK STIRLING..........*General Inspector*
J. H. MONTGOMERY..........*Quarantine Inspector*
H. E. STEVENS..........*Consulting Plant Pathologist*

Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

PORT INSPECTION WORK DURING 1919.—The Port Inspection and Quarantine Service of the State Plant Board is under the supervision of the Quarantine Department. This branch of the State Plant Board's work, although one of the most important, has attracted perhaps the least attention from the general public. The traveling public which comes in contact with the inspectors of the Quarantine Department and is subjected to the rules governing the entry into this State of plants and plant products and the commercial handlers of such material are well aware of the existence of such a force and of the requirements of both the Federal and State Governments. The citizenry as a whole and even the growers of the State hardly know that this protection is being afforded the horticultural and agricultural interests of the State and Nation. The protection is given in the shape of certain rules and regulations governing the movement into the State of plants and plant products and by the presence of competent inspectors at our various ports of entry and railroad centers who apply these rules and regulations. These specially trained men hold appointments from both the Federal and State Governments, but the State of Florida bears all expenses incident to the work.

Much could be written about the work being done by the vigilant inspectors who operate in close cooperation with the officials of the Customs and Immigration Services. A tremendous amount of actual inspection work is done and done with efficiency. During the calendar year 1919 Plant Board men boarded and inspected over 4,000 vessels arriving at Florida ports. More than half of these were from foreign ports. The greatest dangers to which we are exposed exist in foreign countries, particularly those of the Tropics. Consequently special attention is given to boats arriving from tropical ports. The boats are searched carefully from stem to stern, quarters of passengers and crew investigated, cargo overhauled and baggage examined. In the course of the inspection work during the past year 165,000 packages were examined. Of this number more than 3,000 were returned to shippers or were destroyed on account of being infected or likely to contain dangerous material. Many shipments were treated and then passed to destination. In this connection it should be said that the general policy is to so apply the rules and regulations as to occasion the least inconvenience and loss to shippers and at the same time afford protection. The rules are, therefore, applied in a common-sense way with the result that in very few instances has any friction developed. At the ports of Key West and Tampa all fruit and vegetable offerings originating in Cuba and destined to Florida points are subjected to fumigation. This in itself is a tremendous task.

The beneficial results of the Quarantine Inspection work cannot be over-estimated. Repeatedly have inspectors intercepted material infested with insects or infected with plant diseases not known to be present in the United States. For instance, on five occasions inspectors have intercepted "black fly" from Cuba and the Bahamas, several fruit flies from the Tropics have been prevented entry, yams and sweet potatoes infested with serious insect pests have been discovered, and diseased and insect-infested sugar cane has frequently been found. Had these interceptions not been made no one can measure the damage which might have resulted. There are now too many such pests in this country exacting an annual toll of hundreds of millions of dollars from the growers. That this toll be not increased through the introduction of more pests is the duty of our Plant Quarantine Inspectors. If past performances are any guide for future expectation, the farmers and fruit growers will continue to be well protected by the Port Inspectors of the Plant Board.

Prosecutions.—Violations of the nursery inspection law and rules fall into two classes, intentional and unintentional, the latter by ignorance of the law. There is no question concerning the former class, they are dangerous and should be prosecuted. On that we can all agree. But what shall we do about violations committed by those who are ignorant of the law?

There are two ways of looking at the matter. One side argues that the violator should be written fully, advised concerning the law and his future careful compliance and hearty support of the law requested. This side represents that the man will then be fully advised and will have no excuse for a second violation, while the State Plant Board will have his friendship and support rather than his enmity and opposition.

There is another way of looking at the matter, however, and from that angle one sees many objections to the arrangement just suggested. Were such a course followed, all would claim ignorance of the law when caught in their first violations. Secondly, other citizens of the same town would then feel that they were entitled to the same treatment, or in other words, that everyone is privileged to violate the inspection law with impunity at least once.

In the third place, others will see trees thus being moved illegally and think they can move them the same way. Thus one violation will lead to another by precept. If such people heard, however, that the man they saw moving untagged or undefoliated stock was prosecuted for doing so they would be more careful. If he merely receives a letter they will not learn of it and will not be warned.

In the fourth place, those who are once prosecuted for violating the law never forget it. They will warn friends and acquaintances who are getting ready to move stock illegally, to keep them from getting into the same trouble.

Again, strict inforcement of the law is its best advertisement. If the inspection law is strictly enforced it will be on many people's tongues. If it is not rigidly enforced it will never be mentioned.

It is not necessary that a big fine be imposed if the violation is really the result of ignorance. If thought best, the fine can be suspended altogether, pending future compliance. But the fearless, dispassionate prosecution of every violation of the law will be the greatest deterrent of further violations which it is possible to devise.

THE QUARTERLY BULLETIN

State Plant Board of Florida

Vol. IV APRIL, 1920 No. 3

THE SOUTHERN GREEN STINK-BUG* IN FLORIDA

CARL J. DRAKE†

A large green plant-bug, *Nezara viridula* Linn., has long been known as a serious plant and fruit pest in Florida. In 1885 Hubbard‡ (notes and excerpts from correspondence) calls attention to the sudden rise of this insect into economic importance and briefly discusses its depredations upon a number of garden vegetables, truck plants and field crops in addition to the orange trees. During the last decade the insect has been greatly increasing in numbers and its ravages have been especially great, not only in Florida, but in other states bordering on the Gulf of Mexico.

The observations and investigations herein recorded were carried on chiefly at the University of Florida Experiment Station, Gainesville, Florida, during the summer of 1918. All original illustrations, except figures 7, 17, 33, 37 and 39, have been made by the author. Mr. W. C. Wessel has kindly made the drawings for figures 7, 17 and 33. I am indebted to Prof. J. R. Watson for securing the photograph for figure 39, and to Prof. J. B. Thompson for kindly loaning the negative for figure 37. Several illustrations have been secured from the United States Department of Agriculture, the Ohio Agricultural Experiment Station and the Agricultural Experiment Station of the University of Florida; these are duly credited when used herein. At this opportunity the author wishes to express appreciation to Prof. J. R. Watson and to Dr. E. W. Berger for kindly turning over the correspondence and records of the Experiment Station and Florida State Plant Board, respectively, relating to the project and for much valuable criticism and advice. Thanks are also due Mr. Wilmon Newell, Plant Commissioner, for going over the manuscript and suggesting changes. The food plants have been determined largely by Professors Thompson and Watson. Through the co-operation of the County Agents, University of

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**Nezara viridula* Linn.

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‡See footnote, page 52.

Florida Agricultural Extension Division and the Florida State Plant Board staff many living specimens were secured from various parts of the State. A number of farmers and citrus growers have also kindly sent in specimens for breeding purposes.

HISTORICAL

This plant-bug was first described by Linnaeus in 1758 (p.444) under the scientific name *Cimex viridulus* from specimens collected in India. Since then, according to Van Duzee‡ (1917b, p. 58), the insect has been redescribed under numerous other scientific names by various authors. The species is now placed in the genus *Nezara* of Amyot and Serville. Three good color varieties are recognized; namely, *smaragdula* (Fabricius), *torquata* (Fabricius) and *hepatica* Horvath. These color varieties are not known to occur within our limits.

Nezara viridula, like many of our most destructive insect pests, is of foreign origin and was undoubtedly imported to the West Indies and North America many years ago. Owing to the paucity of data it is impossible to conjecture how, when, or even where the insect was introduced into Florida.

CLASSIFICATION AND COMMON NAME

Nezara viridula (Linn.) belongs to the group of insects commonly called the "true bugs" or the suborder Heteroptera of the order Hemiptera. It is placed in the "stink-bug" family called Pentatomidae. The pentatomids are widely known as "stink-bugs" because they emit a very malodorous and ill-tasting substance for protective purposes. This insect is known by a number of common or popular names as the "green-bug," "tomato and bean-bug," "southern green plant-bug," "pumpkin-bug," "green soldier-bug," "green-bug of India," etc. On account of its distribution in the United States (southern part), color (light green), and widely known family name (stink-bug), I have used the name "southern green stink-bug" as a common name for it.

THE ADULT

The adult (typical form) southern green stink-bug (Fig. 6) is a large light green shield-shaped bug. Over-wintering specimens and pinned specimens in collections are sometimes slightly faded, the light green being more or less replaced by a brownish or purplish hue. The average sized individual is about ½-inch

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‡The numbers (years and pages) in parenthesis refer to bibliography, the papers being arranged chronologically for each author. The authors are arranged alphabetically.

long and about 1/3-inch in width. Both male and female are slightly variable in size, the female usually being a little larger than the male. The antennae or feelers are each composed of four segments. The legs and wings are well developed. The beak or rostrum is four-jointed.

Fig. 6.—Adults of the southern green stink-bug (*Nezara viridula*), natural size. (After Watson, Bull. 148, Fla. Agr. Exp. Stat.)

The variety *torquata* (Fabricius) differs from the typical form in having the head, except for a distal green spot, anterior portion of thorax, three small spots at the base of the scutellum, and the connexivum yellow. The variety *smaragdula* (Fabricius) is of the usual green color, but can be readily distinguished from *torquata* by having only three rather large yellow spots at the base of the scutellum. The variety *hepatica* (Horvath) is somewhat similar to the variety *torquata*, but the green color above is replaced largely by sordid brown. The anterior portion of the head and thorax, the basal portion of the scutellum and a mark on the wing are stramineous.

CLOSELY ALLIED SPECIES

Four closely related species of pentatomids, *viridula* Linn., *hilaris* Say, *pennsylvanica* DeG. and *marginata* P. B., occurring in the United States, usually have been placed in the genus *Nezara* of Amyot and Serville, the genus *Acrosternum* of Fieber being considered a synonym of *Nezara*. Dr. Bergroth (1914, p. 25), on the structure of the osteolar canal (Fig. 10, o= osteolar canal) and on the structure of the male genitalia as noted by Sharp (1890, pp. 406-408), pointed out the generic differences between the two genera and raised the genus *Acrosternum* to a valid genus. This leaves only *viridula* Linn. in the genus *Nezara*, the other three species falling in the genus *Acrosternum*. All four of these insects occur in Florida.

Acrosternum marginatum P. B. is a rather rare insect and seems to be a tropical species. It has been reported from southern Florida. Nothing is known of its life history or habits.

Acrosternum pennsylvanicum DeG. is a widely distributed species in the United States. During the summer three specimens were sent to the Florida State Plant Board from Fort Myers. These specimens were taken with a long series of *Nezara viridula* on orange trees and on garden and truck plants. The writer collected one specimen on a small scrub oak near Gainesville on July 4. Lugger reports the species on grape in Minnesota. No report has been made on its life history or habits.

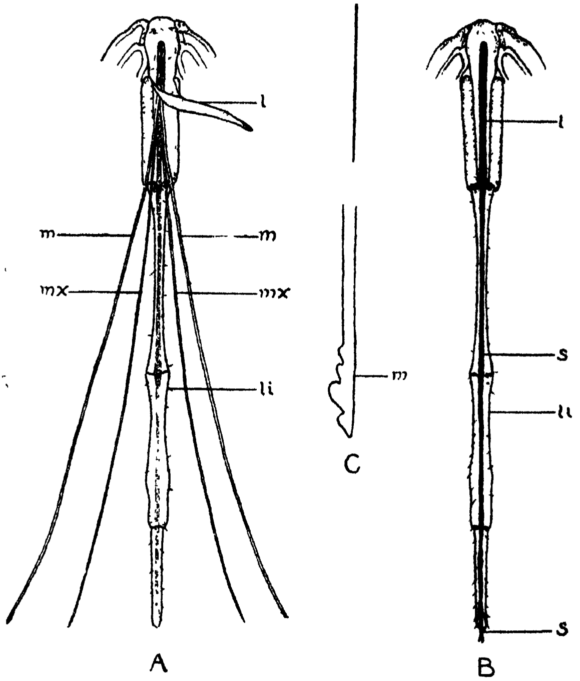

Fig. 7.—Mouthparts of the southern green stink-bug (*Nezara viridula*) :A, dorsal aspect with setae separated; B, dorsal aspect showing setae in normal position within sheath; *l*, labrum; *li*, labium; C, tip of mandible greatly enlarged; *m*, mandible; *mx*, maxilla; *s*, setae within sheath (labium); *s'*, tips of setae. Enlarged. (Original, from drawing by Wessel.)

Acrosternum hilaris Say is commonly known as the northern green soldier bug. In fact *N. viridula* has often been confused in literature in the South under this name. The northern green soldier bug is a transcontinental form that occurs over the greater portion of the United States, becoming more abundant in the northern states. It is distinctly a shrub-inhabiting species, only occasionally being found on herbaceous plants. In this respect its habits are quite distinct from those of the southern green stink-bug *Nezara viridula,* which is primarily an herb-inhabiting form. These two species resemble each other very closely in color, form and size, but they can be readily separated by the shape of the osteolar canal (Fig. 10; o=osteolar canal).

The habits and life history of the northern green soldier-bug have been published by Whitmarsh (1917). In Ohio it occasionally does a considerable amount of damage to peaches. The food plants listed in literature are box elder, dogwoods (*Cornus* *florida* and *C. alternifolia*) wild cherry (*Prunus serotina*), black-haw, common elderberry, catalpa, apple, peaches, oranges, corn, okra, golden rod, egg-plant, cabbage, beans, cotton and seed pods of mesquite (growing near cotton fields in Texas). Less than two dozen specimens of this insect were seen by the author during the entire summer in Florida. In the vicinity of Gainesville the author took it upon *Crataegus* sp. (adults and one egg cluster after incubation), rattle-box (*Crotalaria*), mulberry, wild plum, hop hornbean or ironwood, castor bean and blackberry. The specimen on *Crotalaria*, collected August 10, bore eggs of a tachinid parasite, *Trichopoda pennipes*, the parasite being reared in the insectary. Many specimens of pentatomids and other plant feeding insects were received at the Experiment Station and State Plant Board from various parts of the state during the summer but *A. hilaris* was represented by only four specimens. Several species of brown stink-bugs, belonging to the genus *Euschistus*, also feed upon citrus trees and cultivated plants. The brown color will readily enable one to distinguish them from either *Nezara* or *Acrosternum*.

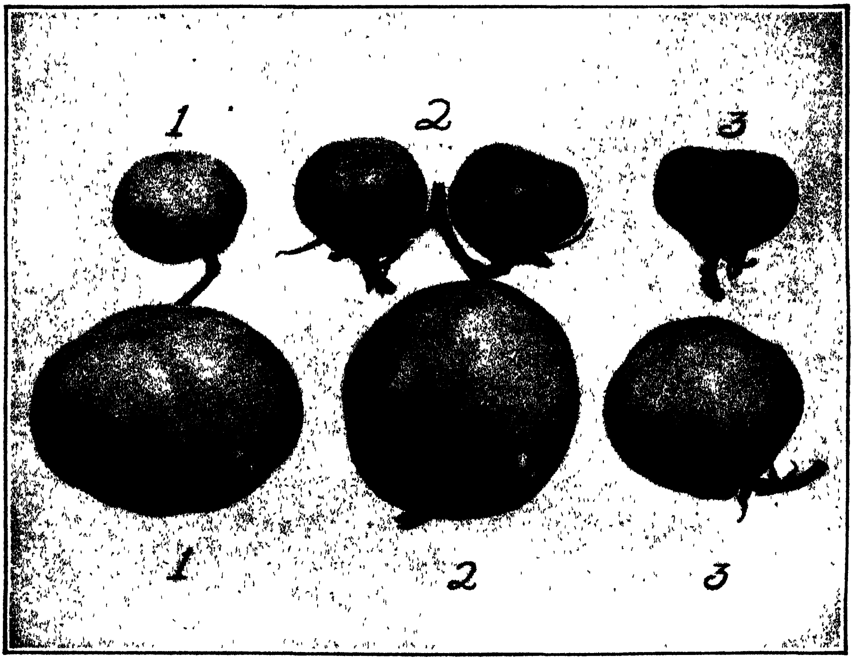

Fig. 8.—Injury to tomato fruit by nymphs of the southern green stink-bug (*Nezara viridula*): Injured fruit above, normal fruit below. Developing fruit was covered with cheesecloth sacks in which nymphs were confined. Fruit bearing same numbers were approximately the same size when enclosed in sacks.

DISTRIBUTION

The southern green stink-bug is one of the most universal and widely distributed species of plant feeding insects. In fact it is found throughout the tropical and neotropical regions of almost the entire world. Lethierry and Severin (1893, p. 167) give its distribution as Europe, Asia, Africa, and America. Numerous records have been published for the West Indian Islands, northern portion of South America, Central America, Mexico and the southern portion of the United States. Distant (1880, p. 79) states that the wind has probably greatly assisted the insect in its wide dissemination; while sailing from India he found several specimens which had been blown aboard the ship when more than a hundred miles southwest of Madagascar.

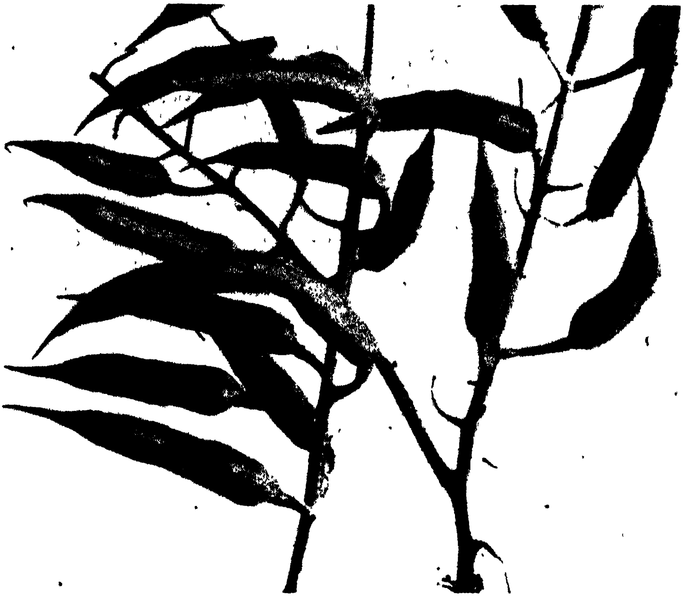

Fig. 9.—Puncture marks on radish pods caused by the feeding of both nymphs and adults (*Nezara viridula*). Slightly enlarged. (Original, photo by author.)

In the United States VanDuzee (1917, p. 58) catalogs the species for Virginia, Florida and Louisina. In addition to these states Jones (1918, p. 11) lists California, Arizona, New Mexico, Texas, Mississippi, Alabama, Georgia, and South Carolina. Bueno (1912, p. 316) records the finding of a specimen in a greenhouse in Brooklyn, New York, and states that it was probably brought in on plants from Florida or introduced from Europe. Prof. J. G. Sanders kindly sent the writer two specimens which were collected at Hummelstown, Pennsylvania, by Mr. J. N. Knull. The numerous published records and the many letters in the files of the Florida Experiment Station and the Florida State Plant Board show that the insect is common over the entire state of Florida, often becoming a serious pest in many places.

FOOD PLANTS†

In nature the southern green stink-bug feeds upon many different kinds of plants. It is distinctly an herb-inhabiting and herb-feeding species; only occasionally are shrubs and trees infested. All parts of a plant are attacked, but it is particularly at home on the fruit and on the tender growing shoots. This applies to the nymphs (the young) as well as to the adults.

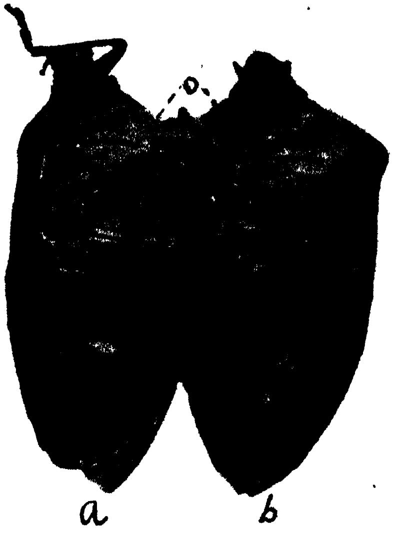

Fig. 10.—Ventral view showing (o) osteolar canal: a, *Nezara viridula*; b, *Acrosternum hilaris*. Enlarged, photo by author.

Various authors have cited the insect as feeding on radish*, mustard*, turnip, collard*, cauliflower, cabbage, okra*, beggarweed*, peas*, cowpeas*, peanut*, beans*, tomato*, potato, tobacco, Brussels sprouts, sweet potato, cotton*, pepper, *Gynandropsis pentaphylla,* eggplant, sunflower, sugar cane, corn or maize, rice, pecan, lime, peaches, grapefruit, orange*, lemon, hackberry and mulberry. In addition to a number of the above plants the writer has found the insect feeding on rattle-box* (*Crotalaria usaramoensis*), everlasting pea* (Lathyrus sp.), butterfly pea* *(Clitoria* sp.), Mexican clover* *(Richardsonia scabra),* sorrel* *(Rumex* sp.), wild blackberry, wild grape (*Vitus* sp.), castor bean*, passion flower or maypops* *(Passiflora incarinata),* wild plum *(Prunus* sp.), an introduced cereal plant* (*Amaranthus leucocarpa*), spiny amaranth* *(Amaranthus spinosus), Amaranthus* spp.* (two wild species), nut grass* (*Cyperus esculentus*), lamb's quarters*, (*Chenopodium acuminatum),* chayote*, cucumber*, pepo or crook-neck squash*, Japanese pumpkin*, sandbur or bur grass* (*Cenchrus sp.*). In late fall specimens have been taken on pokeweed by Dr. Berger, and on dwarf Essex rape by Prof. Watson. The insect feeds upon all varieties of cowpeas, peas and beans, but not enough data have been collected to determine the varieties less susceptible to attack.

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†In addition to the plant feeding habit Hubbard (1885, p. 159) reports that the insect is, to a certain extent, predaceous. Prof. J. R. Watson can state irrefutably that the insect will sometimes bite man. The writer has failed to observe or to make the insect feed upon other insects and in handling several hundred specimens has never been bitten.

*See footnote p. 48.

The long list of food plants shows that the insect is a very general feeder and that it can subsist upon a great variety of plants. However, it probably does not breed, at least in great numbers, on all these plants and only occasionally feeds on a number of them. Observations show that the insect has a very decided preference for a few plants. This preference, of course, varies with the development of the preferred food plants and in different seasons of the year. Watson (1918, p. 231), states "It breeds particularly on such legumes as cowpeas and beggar-weed and when these plants are grown as a summer crop in the (citrus) groves and allowed to stand too long, the bugs attack the citrus fruit." Jones (1918, p. 14) states "In the late fall and early winter the various stages are often abundant on mustard and turnip." The author found radish and collard (both growing in the same row) to be greatly preferred by the bugs in spring and early summer; in fact so alluring that tomatoes and other garden and truck crops growing in the same patch or even in adjoining rows were scarcely infested at all. Rattle-box, an introduced forage plant on the Station grounds, proved to be one of the most attractive plants to the insects during July, August and September; this plant served a double purpose as the parasites were greatly attracted by its flowers. The marked preference for preferred food plants, such as radish, cowpeas, rattle-box and begger-weed, is greatest by far during the period of fruit formation. After the fruit is mature and lignification has set in, the bugs wander to more succulent plants. This was nicely illustrated during

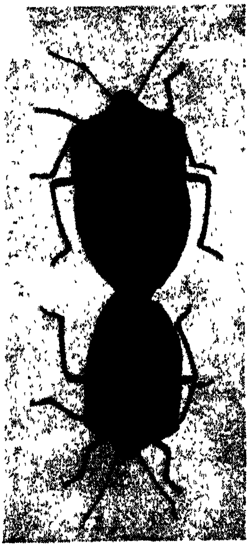

Fig. 11—Male and female of the southern green stink-bug (*Nezara viridula*) in the act of mating. Slightly enlarged. (Original, photo by author.)

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*Eggs or young nymphs were found on this plant at Gainesville during the summer of 1918 by the author.

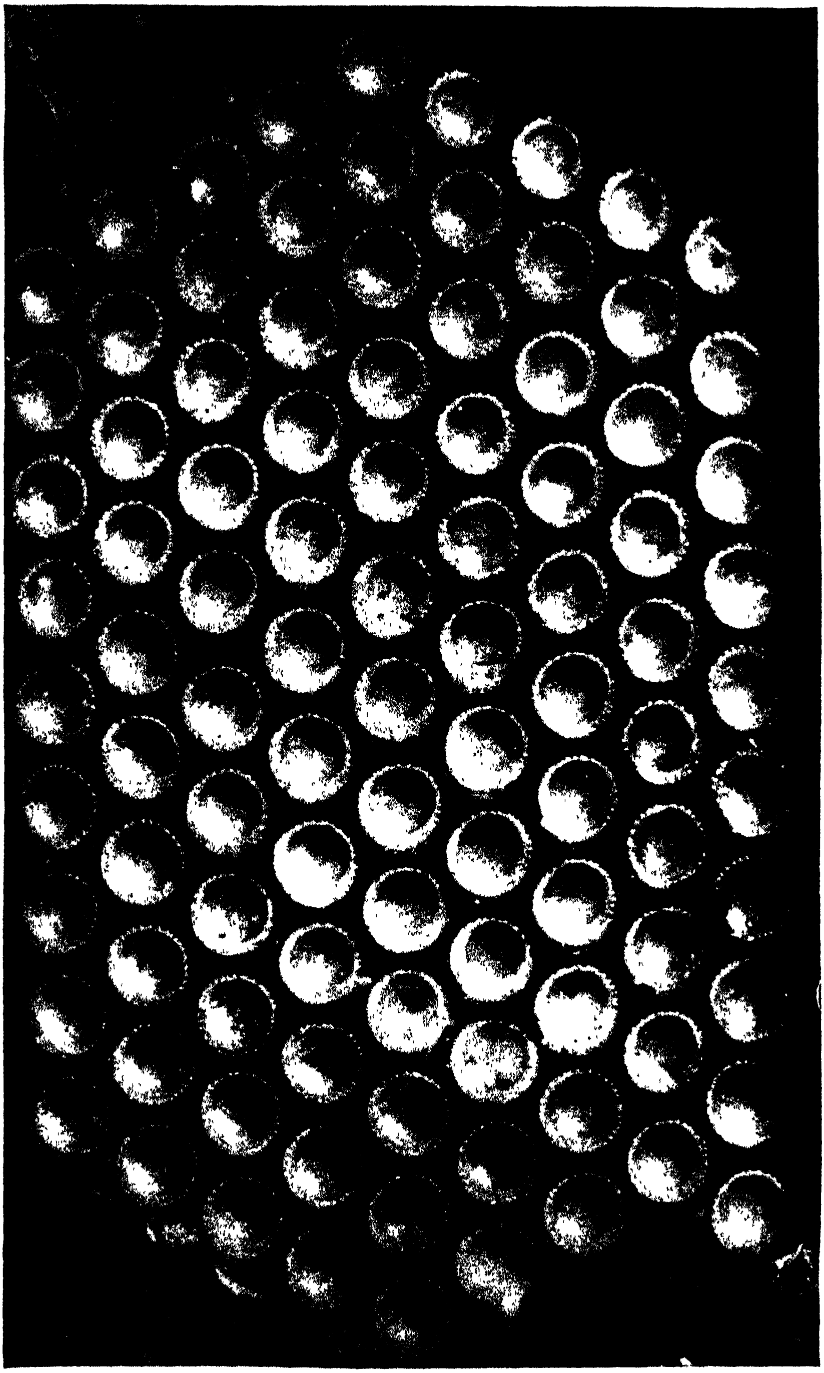

Fig. 12.—Egg cluster of the southern green stink-bug (*Nezara viridula*) before hatching. Greatly enlarged. (Original, photo by author).

the summer on some plots of cowpeas that matured on slightly different dates. The difference of time of maturing was due to different varieties of plants or that the same variety had been planted on different dates. Young plants were not at all or only slightly infested while fruiting plants were usually very severely infested. On the other hand, mature plants, as a rule, were only

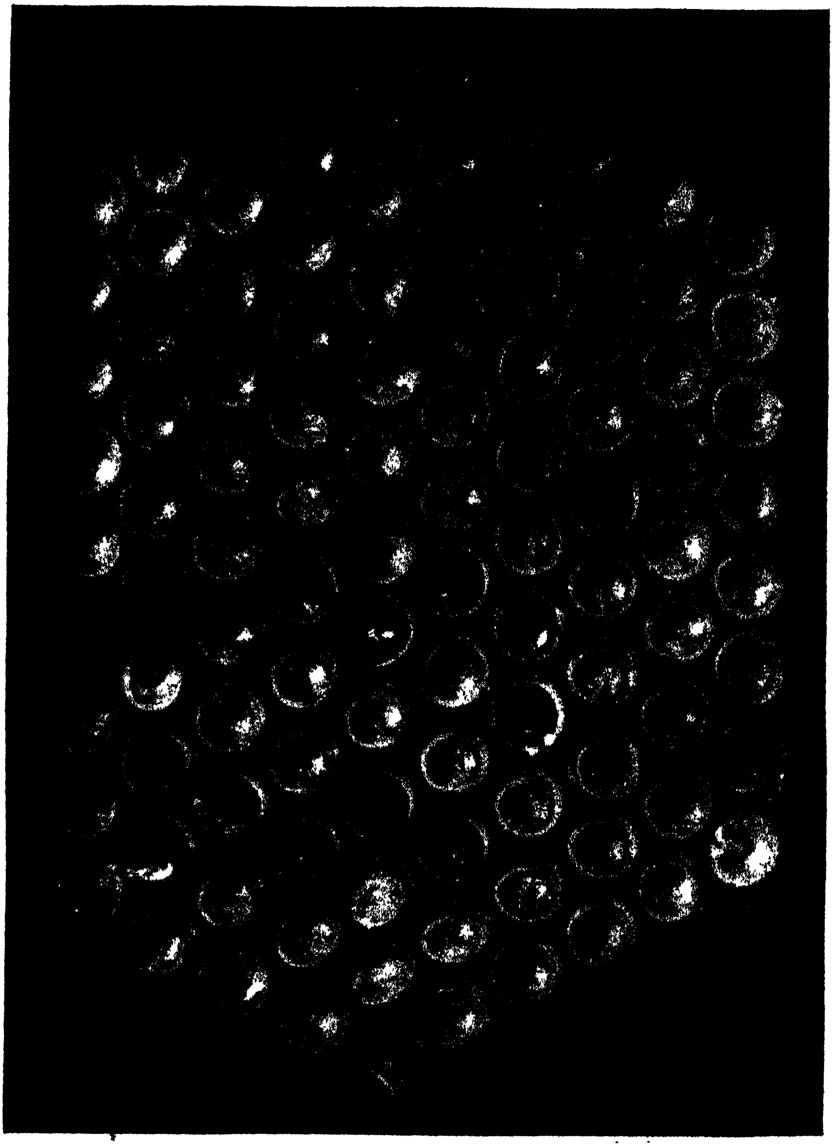

Fig. 13.—Egg cluster of the southern green stink-bug (*Nezara viridula*) after hatching. Greatly enlarged. (Photo by author.)

slightly infested because the bugs, as they matured, migrated to other food plants. No food plants, the preferred ones included, are desirable for the bugs after the fruit has matured or lignification has set in.

METHOD OF SECURING FOOD

The mouthparts of the southern green stink-bug (as in all Hemiptera) are modified to form a structure for piercing and sucking. This structure (Fig. 7) is known as the beak or rostrum and when not in use it is carried flat close to the ventral portion of the body between the legs (Fig. 10). This beak or rostrum is an elongated, four-jointed, tube-like structure, containing four long, lance-like setae (Fig. 7; B). The thicker and heavier pair of setae are called the mandibles (Fig. 7; B. m) and the thinner pair the maxillae (Fig. 7; B, mx). These four setae, the mandibles and maxillae, are sharp-pointed structures which pierce and enter the plant when the bug feeds. It is capable of taking only liquid food.

NATURE OF INJURY AND ECONOMIC IMPORTANCE

Both nymphs and adults obtain their food by puncturing the tissues of plants with their beaks and then extracting the plant juices. They attack all parts of a plant, as stem, foliage, flower and fruit, but greatly prefer the young tender growth and fruit. The numerous feeding punctures, caused by the insertion of the rostrum, make minute, hard, brownish or blackish spots on the plant. These spots are not only unsightly, but sometimes they are the avenue for infections and decay.

On mature fruit, the feeding punctures seriously mar its ap-

Fig. 14.—Later view of the eggs of the southern green stink-bug (*Nezara viridula*) on radish pod. Greatly enlarged. (Photo by author.)

pearance, greatly affect its edible qualities, and decidedly lower its market value. Such fruit is consigned to an inferior grade, or in the case of severe infestation it becomes worthless and must be discarded. Attacked, young immature fruit is much retarded in growth and greatly distorted, or hard callouses form around the punctures. Sometimes it even drops from the plant before or after maturity. Young plants and young growing shoots are greatly retarded by their attacks and, occasionally, they are even entirely destroyed or fail to bear fruit. Such injury has been noted on a number of cultivated plants in gardens and fields, also on young orange trees and on the tender growth of older trees.

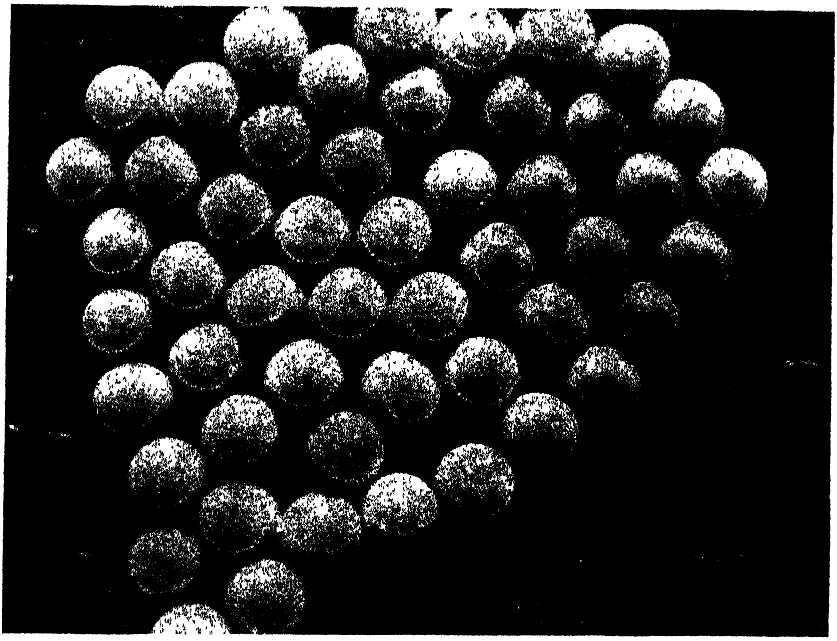

Fig. 15.—Egg cluster of the northern green soldier-bug (*Acrosternum hilaris*). Greatly enlarged. (After Whitmarsh, Bull. 310, Ohio Agr. Exp. Stat.)

To quote from the first published account of the ravages of this insect by Hubbard* (1885, pp. 159-161; from correspondence of James Franklin, West Apopka, Fla., Jan. 31, 1883):

> "They mature very quickly, and increase with surprising rapidity, continuing to breed until November. In the spring and early summer they

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*Hubbard gives this account under "The Green Soldier Bug" or *Raphigaster hilaris* Fitch, but he undoubtedly refers to *Nezara viridula* Linn. as *hilaris* Say (the northern green soldier-bug) has never been known to occur in great numbers in Florida. Riley and Howard (1893, p. 264) state "* * * the species which he (Hubbard) figures upon page 160 is in all probability the same as your number 2 (*Nezara viridula*) * *."

confine their attacks principally to garden vegetables and succulent weeds. They are particularly abundant on tomato vines, egg-plants, turnip tops, and mustard, seldom doing much damage to the orange trees at this season. When pea-vines are well grown, about or a little before the time of blossoming, they abandon nearly everything for the pea-vines. Last year they totally destroyed my garden. Not one tomato came to perfection. Where the insect had inserted its sucking-tube a reddish yellow spot appeared. When cut the fruit was full of lumps and totally devoid of flavor. The tomato vines grew so enormous a crop that the ground was almost covered by the fallen fruit. Last year I had 35 acres planted in cow-pea vines, which bore an enormous crop of peas; but not enough sound peas could be gathered to plant 5 acres of additional land. Later it was impossible to find a sound pea. I attempted to turn under the vines, but so luxuriant was the growth that it could not be done. Towards the end of August the pea-vines were dead or dying, when the bugs swarmed to the orange trees, killing nearly all the new growth. Immense numbers were killed by keeping men constantly going over the grove, shaking the trees, and killing all that fell on the ground. The wingless individuals were readily killed, but a large number of mature insects saved themselves by flight. * * * The number of insects is incredible. When thoroughly shaken, the ground under the trees would be alive with fallen insects, and two days later just as many would be found."

Watson (1918 a, p. 59R) gives the following report of the insects on citrus:

"Many complaints of damage done to citrus by plant-bugs were received in October and November. Plant-bugs attack the young shoots of the trees causing them to wilt and die. In young groves they often do considerable damage in this way during the summer. On large trees the damage is negligible. It is the fruit that sustains the most severe damage. This turns yellow around the punctures which, if sufficiently numerous, cause the fruit to fall. These fruits are dry and tasteless, the juices having been withdrawn by the bugs. Tangerines are most severely attacked; oranges are the second choice, while grapefruit is not much troubled."

Many complaints were received during the past year (1918). A letter from Mr. F. D. Waite of Palmetto, Florida, states:

"We estimate that we threw away one thousand crates of tomatoes which were bug-sucked and 500 crates put in seconds that were damaged to some extent by the same bug. The damages or loss, at prices received during the past season, would amount to at least $4,000 on 14 acres of staked tomatoes. As they were staked we were able to gather the bugs

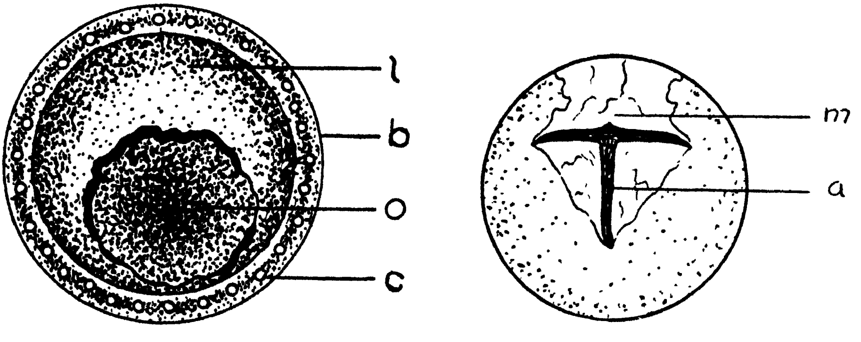

Fig. 16.—Dorsal aspect of the eggs of the southern green stink-bug (*Nezara viridula*): *l*, disc-shaped lid or cap; *b*, outer wall or barrel of eggshell; *c*, chorial process; *o*, hole in lid made by egg-parasite in escaping from the egg; *a*, T-shaped egg-burster; *m*, membrane Enlarged. (From drawing by Wessel.)

by hand and employed women and children almost constantly for two months. The bugs at first were noticed working on what we call cockspur weed around the margins of the tomato fields."

"The bugs have been increasing every season and we find them all over our 500 acres of groves, but only twice have they done much damage to the oranges."

Dwarf Essex rape is a very desirable food plant during late fall and winter. Prof. Watson states:

> "There are thousands of the bugs on this plant in the fields during December. In fact it seems to be one of the most attractive plants just now. There is a distinct tendency to collect in colonies, a tendency not observed in summer time. Under some leaves I found as many as a dozen adults in a group. I could easily see where the bugs were when the bugs themselves were out of sight. Even one bug on a leaf seems to be capable of wilting it. Only a very few specimens bore tachinid* eggs on their bodies. I noted an adult tachinid fly the other day, but they are quite scarce now."

Dr. W. E. Hinds states that *Nezara viridula* has done extensive damage in southeastern Alabama, particularly in the fall of 1916. He believes that the insect is spreading and increasing in injuriousness in Alabama (from Station correspondence).

In Georgia, Turner (1918, p. 491) reports the insect as a serious enemy upon pecans, and that there was a severe infestation during 1916. In the groves, cowpeas are commonly grown as a soiling crop during the summer, the vines being turned under late in the fall. In September or early October, after the cowpeas have matured and the vines begin to dry up, the bugs leave the cowpeas and migrate to the pecan trees. In some cases the

Fig. 17.—Nymphs of the southern green stink-bug (*Nezara viridula*) showing gregarious habit during first instar. Enlarged. (Photo by author.)

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*See family Tachinidae, p. 67.

bugs have been observed feeding upon the nuts. Experiments are being conducted by Turner to determine the relationship between the feeding punctures of the bug and the kernel spot of pecan. So far the data obtained strongly indicate that *Nezara viridula* is an important agent in either the actual production or the dissemination of the disease. Similar experiments with *Nezara viridula* and other plant feeding bugs, are being conducted by Nowell (1918, p. 217), in the West Indies, on the internal diseases of the cotton boll.

In India, Atkinson (1889, p. 4) calls the insect the "green bug of India" and states that it did considerable damage, in 1889, to the potato halms. According to Froggatt (1916, p. 649) the species has been recently introduced into Australia and the number of individuals has been increasing very rapidly. In the neighborhood of Sidney it is a pest upon potatoes, tomatoes and French beans. It is commonly called the "tomato and bean-bug" in Australia.

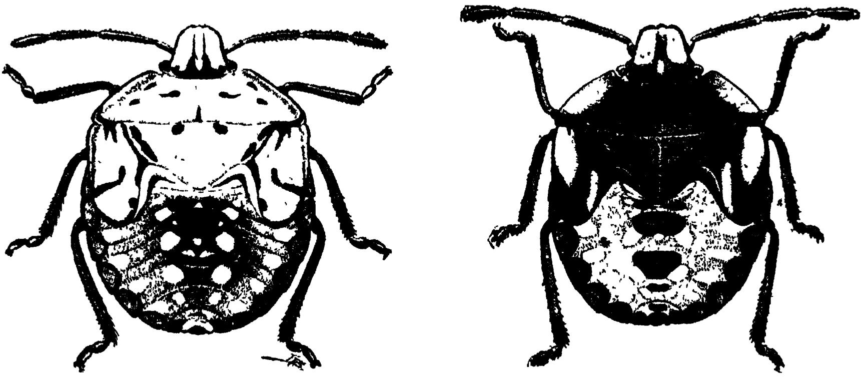

Fig. 18.—Light and dark colored forms of the southern green stink-bug (*Nezara viridula*) ; fifth instar, enlarged about 4 diameters. (After Jones, Bull. 689, U. S. D. A.)

HABITS AND LIFE HISTORY

Hibernation

In Florida, as well as in the other states bordering on the Gulf of Mexico, the hibernation of the southern green stink-bug is only partial, a few of the adults remaining upon succulent plants throughout the entire winter. Watson (1918 b, p. 232) states: "They are abundant in October, plentiful in November, common in December but rather scarce in January and February." In the southern portion of the state the bugs are more abundant and active during the winter months. Many stragglers or belated nymphs of the last brood are found in the fields during late fall and early winter. These, at least the most of them, are able to mature and to seek favorable hibernating quarters during the warmest hours of the day. However, there are no winter broods in the State and only adults are found throughout this season of the year.

The hibernating forms secrete themselves beneath the loose bark of trees and logs, among and beneath fallen leaves, in

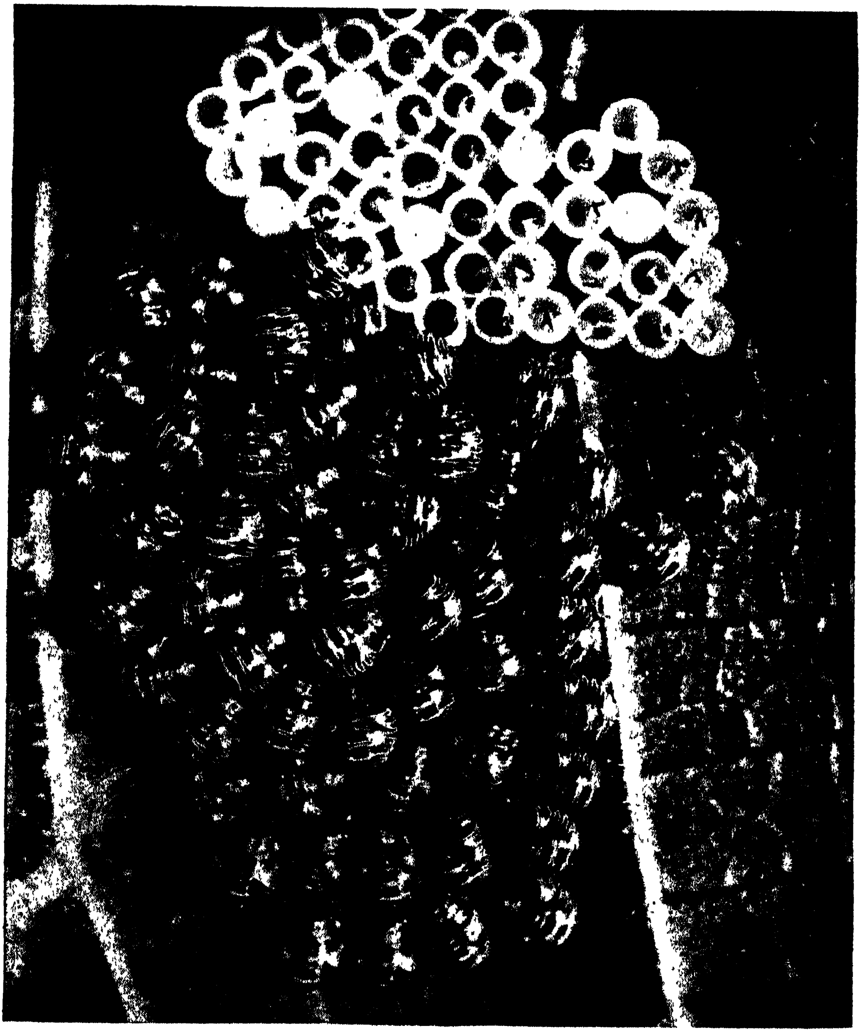

Fig. 19.—Cluster of nymphs of the northern green soldier-bug (*Acrosternum hilaris*) showing gregarious habit during first instar. Greatly enlarged. (From Whitmarsh, Ohio Agr. Exp. Stat. Bull. 310.)

Spanish moss, under boards and sticks and in almost any secluded place that offers a slight protection from the weather. In Louisiana, Rosenfeld (1911, pp. 401, 403, 404 and 405) enumerates the species among the insects and spiders found hibernating in Spanish moss during the months of December and January. Dozier found several specimens beneath the bark of dead "live oak" on the campus of the University of Florida. Prof. Watson states that hammocks afford the most favorable retreats for the bugs in Florida and that the food plants, either wild or cultivated growing close to hammocks are the first to become badly infested in early spring. The individuals that overwinter on food plants afield are quiet and somewhat sluggish or even torpid on cold days, but rather active and often feed during the warmest hours of warm days during mild weather.

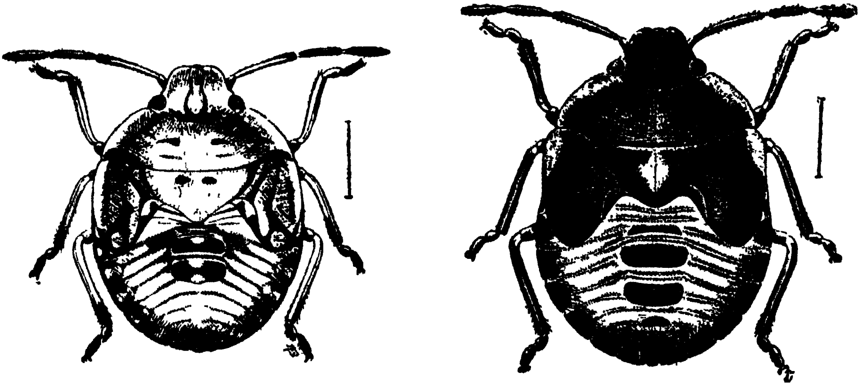

Fig. 20.—Light and dark colored nymphs of the northern green soldier-bug (*Acrosternum hilaris*) ; fifth instar. Enlarged about 4 diameters. (After Jones, Bull. 689, U. S. D. A.)

Copulation

On the approach of warm days in early spring the hibernating forms wander from their secluded winter haunts in search of food. Mating begins almost immediately. This is about the middle of March or a little later in the vicinity of Gainesville and somewhat earlier in the southern part of the State. During copulation the male and female (Fig. 11) face in an opposite direction with the caudal extremities of their body together. They are somewhat sluggish at this time and are not readily disconcerted. If molested, they fall to the ground, usually not becoming detached from each other. No pairs have been observed in flight while mating, but feeding continues normally. The process has been timed and found to vary considerably in different pairs. It is not uncommon for a pair to remain constantly *in coitu* for a day or even longer. Under natural conditions copulation is repeated a number of times until the eggs have been deposited.

Both field and laboratory observations show that the males are polygamous and the females polyandric. After feeding a few days newly emerged adults reach sexual maturity. This period was found to vary from about three to five weeks or in some cases even longer.

Oviposition

At Gainesville, the overwintering adults begin to deposit eggs about the middle of April. The eggs are usually placed in very regular clusters (Figs. 13 and 14) upon the surface of the host plants, preferably on the underside of the leaf, where the insects are feeding or resting. At the time of deposition the eggs are covered with a viscid liquid which glues the eggs to one another and to the surface of the plant upon which they are laid.

The process of egg-laying has been observed by the writer in the laboratory. The first eggs are deposited so as to form an inverted V-shaped row (Fig. 12, top of page). This forms two of the narrower sides of the cluster. After depositing this row the female remains in the angle of the V. Just as she is ready to lay another egg, she puts her ovipositors against the egg at one end of this row, then tilts her body slightly forward and drops an egg. As the egg leaves her body it is guided by the ovipositors and placed on end with the cap or disc-shaped lid up against the other eggs. The ovipositors are immediately placed against the sides of the freshly laid egg, probably to straighten it slightly and to hold it in its normal position for an instant while the glue hardens. In a like manner another egg is laid, and thus the process continues until the entire egg cluster has been deposited. One, two or even three rows may be in the process of formation at a time. Only a few seconds are consumed in dropping and placing an egg in its normal position, but the interval between the laying of two consecutive eggs varies in different females from one to four minutes. Ordinarily, the average sized egg cluster is deposited in about an hour and a half to two or three hours.

The Eggs

The Egg Cluster.—The eggs are generally laid in regularly shaped, compact, hexagonal clusters in which the individual eggs are arranged in very regular rows and firmly glued together. Figures 12 and 13 illustrate the two most common forms of egg clusters found in the field. At the time of deposition the eggs are light yellowish white or cream in color.

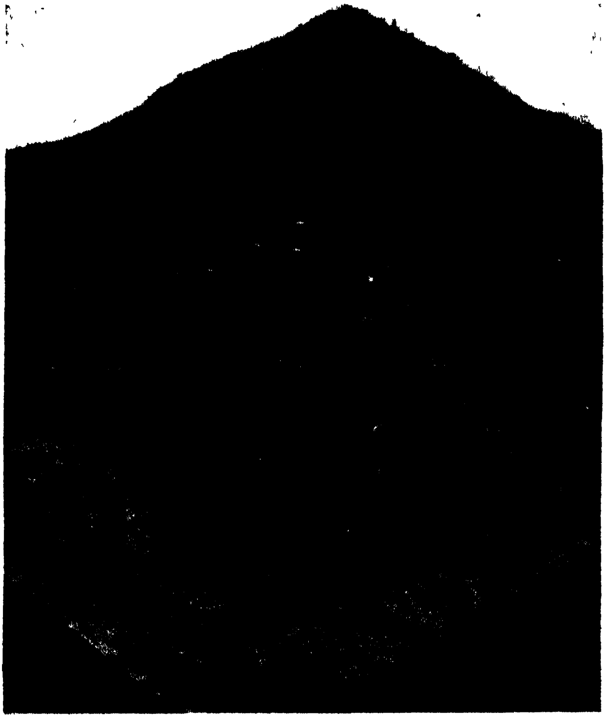

Fig. 21.—Adult of southern green stink-bug (*Nezara viridula*) bearing eggs of a tachinid parasite (*Trichopoda pennipes*). Enlarged. (Photo by author).

During the summer of 1918 many egg clusters, which had been deposited by insects not in confinement, were collected on various food plants in the fields. These egg clusters, with one exception, were composed of from 61 to 126 eggs. A small cluster found on a radish pod during the third week in May contained only 46 eggs. In Louisiana, Jones (1918, p. 15) states: "Egg clusters deposited outside of confinement and examined by the writer have, with one exception, been made up of from 60 to

116 eggs. A cluster taken on November 3 contained only 36 eggs."

The Egg.—The egg (lateral view, Fig. 15) is light yellowish-white in color, somewhat cup-shaped, flat on top, the top being closed with a disc-shaped cap or lid. On the top quite regularly arranged in a circle around the disc-shaped cap or lid are about 30 delicate, club-shaped, chorial processes. These processes are attached by their smaller ends, the larger ends usually pointing obliquely upwards towards the center of the lid. The outer surface of the chorion, or egg-shell, shows minute traces of hexagonal markings. The egg is a little longer than wide, being about 1/20 of an inch in length and 1/29 of an inch in width.

According to Whitmarsh (1917, p. 523) the egg of the green soldier bug, *Acrosternum hilaris* (Fig. 15) has about 65 chorial processes on top of the egg. The author agrees with Jones (1918, p. 5) in finding the number of chorial processes on top of the egg of the southern green stink-bug, *Nezara viridula* (Figs. 13 and 14) to range from 28 to 32. The number of chorial processes will readily enable one to discriminate between the eggs of the two species.

Fecundity of the Females

Numerous adults, reared from eggs deposited in the insectary or from both eggs and nymphs collected in the field, were placed in breeding cages and kept until their death. These reared adults, a male and female being placed in each cage, were confined in ordinary glass tumblers or glass stender dishes until their death. Green tomatoes, radish pods, and cowpea pods were used almost exclusively for food.

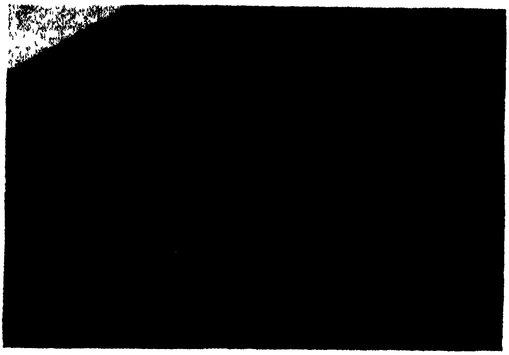

Fig. 22.—Hole through body of host (*Nezara viridula*) made by young maggot of tachinid fly (*Trichopoda pennipes*), egg-shell removed. The young tachinid maggot escapes from the egg by making a hole through the attached or flat side of the egg-shell and body wall of host. Greatly enlarged. (Photo by author.)

The number of eggs and the number of clusters of eggs deposited by different females are somewhat variable. The majority of the females only laid one cluster of eggs, but several laid two clusters and a few laid even three. On the other hand, a few females never deposited any eggs at all. In some cases eggs were found at death in the ovaries of females that had deposited no eggs or that had deposited one, two or even three clusters of eggs; in other cases no eggs were found. One of the females, which had deposited three clusters of eggs (78, 70 and 64 eggs respectively), laid a total of 212 eggs. No eggs were found in her ovaries at death. In Louisiana, Jones (1918, pp. 16 and 17) states that a female deposited a total of 240 eggs (3 clusters of 87, 83 and 70 eggs respectively) and that 77 eggs were found in her ovaries at death. Most of the females deposited an egg cluster in about three to five weeks after becoming an adult.

Incubation

Early in the incubation period the eggs begin to turn pinkish and a red crescent spot appears on the lid or cap. These colors gradually grow deeper and more conspicuous until hatching. After hatching the chorion, or egg-shell, is whitish. The average time for incubation during the summer is about six days. A few clusters have hatched in four days, but during early spring and late fall the period of incubation is often greatly extended, the time varying from about two to three weeks and sometimes a little longer. This variation in time, of course, is due largely to the fluctuations in temperature during the different seasons of the year. No attempt has been made to find the effects of moisture or the direct rays of the sun upon incubation.

The method of hatching is similar to that of many other pentatomids. The nymph escapes through a circular opening at the cephalic or head end of the egg by opening the disc-shaped cap or lid. The lid is opened by means of a T-shaped structure called the egg-burster or lid-opener (Fig. 16), the cap usually remaining attached to one side of the egg-shell. By means of pressure from below, the lid is loosened and forced upwards and the head of the nymph, surmounted by the egg-burster, gradually makes its appearance beneath the partially opened lid, the legs and antennae being closely appressed to the ventral surface of the body and directed posteriorly. The emergence is rather slow, the nymph gradually working its way out until the antennae and legs are free and only the tip of the abdomen remains in the egg-shell. The nymph is thus held in an erect position, but, as soon as the antennae and legs are capable of free movement, the nymph pulls the tip of the abdomen out of the egg-shell and walks to one side of the cluster or slightly off of it. Here it remains quiet in a resting position with the other newly hatched nymphs (Fig. 17) for a few days. The hatching of an egg cluster usually takes place irregularly, thereby giving room for the movement of the appendages while the emerging nymph is held in an erect position. Normally, about five or six minutes are consumed from the time the nymph makes its appearance beneath the partially lifted lid until it has entirely escaped from the egg, the entire egg-cluster generally hatching in about an hour and a half. The egg-burster or lid-opener (Figs. 13 and 16) usually falls back in the egg-shell, being attached to one side by a thin, delicate membrane. Sometimes both the egg-burster and the disc-shaped lid may be entirely removed from the egg-shell during hatching.

Nymphal Instars*

The immature form is represented by five nymphal instars. Each of these instars is quite distinct and displays characters and color patterns which are sufficient to discriminate the instar. The antennae of the nymphs are each composed of four segments, the adult having five. No wings are present, the fifth instar having only wing-pads. In moulting or shedding its skin the outer skin splits open on the dorsal surface along the median line of the head and thorax and the nymph gradually works its way out, leaving the old cast-off skin behind. The nymph moults five times before reaching the adult state.

First Instar.—At the time of hatching the nymph is slightly longer than the egg, oval in outline, strongly convex, and with the antennae and legs quite stout. The general color is light yellowish orange with the eyes and a broad inverted v-shaped mark on the head crimson. Sometimes, there are traces of crimson lines on the thorax and abdomen. The legs, antennae and beak are without much color and nearly transparent.

In a short time the general color gradually grows darker and the color markings begin to make their appearance. The mature form, just before moulting, is about 1/16 of an inch long and 1/23 of an inch wide. The eyes are deep red and the broad inverted v-shaped area on the head is either crimson or brown. The thorax is brown, with the central portions of pro- and mesothorax yellow. The abdomen is generally darker than the head and thorax, being mostly dark brown or nearly black. On either side of each segment there is a nearly semicircular, yellowish or yellowish-brown spot. The three somewhat rectangular areas, the anterior one much narrower than the others, are dark reddish brown. In addition to these markings there are usually four white or cream-colored spots on the abdomen.

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*For a technical description of the different nymphal instars, see Jones, 1918, pp. 8-11.

The body beneath is yellow tinged with red, becoming darker on the abdomen. The semicircular, yellowish spots, as noted on the dorsal surface of the abdomen, are usually present. The legs, antennae and beak are light yellow, the tip of each dusky.

During the first instar the nymphs normally cluster together (Fig. 17) near or on the egg-shells. No individuals have been observed to feed while clustered. Just before or subsequent to moulting, the nymphs become active, scatter more or less and begin to feed. The nymphs, like the adults, greatly prefer the tender growing shoot and especially the developing fruit as food.

Second Instar.—The mature form in this instar is about ⅛ of an inch in length and nearly 1/12 of an inch in width. The head and thorax are black, the latter with two yellow spots on either side near the outer edge. The abdomen is reddish black with a number of light spots which are either whitish or light yellow. The eight semicircular spots on either side of the abdomen, one on a segment, are black. The body beneath is black, the abdomen becoming reddish with the tip black. Some color spots, corresponding to those on dorsal surface, are also present. The legs and beak are entirely black. The antennae are black, except for red areas between the second, third and fourth segments.

Third Instar.—In the third instar the shape and color pattern is much the same as in the previous instar. Sometimes, however, the black may be mostly replaced by olive green. The mature form is slightly variable in size, being about 1/7 inch in length and 1/10 inch in width.

Fourth Instar.—The general form and shape in this instar does not differ from the preceding, except that there is a greater variation in the size of different individuals. The average form is about ¼ inch in length and slightly more than 1/6 inch in width. In the fourth and fifth instars there are two color forms, the light color form and the dark color form. There are, of course, intermediate color forms that connect up the light and dark forms.

Light color form: The head and thorax are pale green with a few scattered black dots and black markings and black outer margins. The pro- and mesothorax have orange-colored areas on each side. The eyes are black. The abdomen is a shade darker green than the head and thorax, darkest around salmon-colored areas. A row of two or three spots on median line, a row of five spots on each side of median line, and another row of six spots on either side close to the connexivum are white. The salmon-colored areas, two on median line and six near either outer margin on connexivum, are bordered with black. Head and thorax are pale green beneath, bordered with black, the thorax with black dots and lines and with an orange-colored space near the inner border. The last two segments of the beak and the tibiae and tarsi of the legs are fuscous. The first segment of the antennae is mostly light green and the others fuscous.

Dark color form: The general color is dark brown to nearly black. The white spots on the abdomen are about the same as in the light form, but the salmon-colored areas are wanting. The thorax contains two yellowish areas, one on pro- and the other on mesothorax; each side of thorax and the latteral lobes of the head are sometimes yellowish. The legs, antennae and beak are greenish black. The body beneath is greenish black, the abdomen yellowish tinged with red and margined with greenish black. The thorax has light yellowish areas on both the pro- and mesothorax and the abdomen has a row of five greenish black spots on the median line.

Fifth Instar.—The shape in this instar is about the same as in the others, but the wing pads are now quite conspicuous and cover the basal portion of the abdomen. The size is quite variable in different specimens, the average individual being about 2/5 of an inch long and ¼ of an inch wide.

Light color form (Fig. 18): The head, thorax and wing pads are pale green with black borders on the sides, a few black dots and other markings. The abdomen is pale yellowish green with the rose-colored spots on median line and connexivum black-bordered. The other spots are yellowish white and not so prominent as in the preceding instar. The body beneath is about the same as in the light colored form in fourth instar, the abdomen differing in having a rose-colored area along the outer black border.

Dark color form (Fig. 18): The dorsal surface of the thorax is usually a little darker than indicated in the figure. The general color is dark brown to nearly black, the abdomen becoming darker. The lateral lobes of the head are orange-colored and there are also orange-colored areas on the thorax. The rose-colored area and white-colored spots on the abdomen are about the same as in light colored form. The head and thorax beneath are olive green with black markings, the latter having also orange areas. The abdomen beneath is light yellow somewhat tinged with red and margined with black. There is a row of four greenish black spots along the median line and rose-colored areas, corresponding to those on the dorsal surface, of the connexivum. The legs are olive green, becoming darker to black towards the tips.

Length of Instars

Table 1.—Table 1 is based on individuals reared in separate breeding cages in the insectary. The food consisted of green tomatoes and pods of radishes and cowpeas. The cages were placed on a table just out of the direct rays of the sun and the food changed every two or three days. The cages were examined and records taken twice a day, about 8 o'clock in the morning and 5 o'clock in the afternoon. The temperature, moisture, sunlight and food supply were as near alike in each cage as could be obtained in a laboratory without control apparatus. The records of different individuals in either lot A or lot B will indubitably prove that it is not safe to assume that an individual, which moults first from a single egg cluster, will continue to moult first in succeeding instars until it reaches the adult state. All nymphs from any one egg cluster usually spend the same or about the same amount of time in the first and second instars, but the period of time for the other instars is quite variable.

In lot B of Table 1 two specimens (cages number 8a and 9a) passed the egg and nymphal instars in 28 days. This was the minimum record for the summer. In the same lot another individual (lot B, cage number 2a) required 48 days to pass through the same stages under similar conditions.

The minimum time for the different instars, when based on different individuals in table 1, is as follows: 1st instar—3 days; 2nd instar—3 days; 3rd instar—1 day; 4th instar—4 days; 5th instar—3 days. This gives a total of only 14 days for the nymphal stages, but, as this is based on several individuals, it probably does not hold true for one individual. 24 days is the minimum time secured for one nymph to pass the five instars (from the same table). The period for the different instars is much lengthened during cool weather of spring and fall.

TABLE 1.—LENGTH OF INSTARS OF NEZARA VIRIDULA BASED ON INDIVIDUALS REARED IN SEPARATE BREEDING CAGES.

Cage No.	Eggs		Period of Incubation	Date of Moulting and Number of Days in Different Instars										Total No. of Days from Egg to Adult
				First		Second		Third		Fourth		Fifth		
	Laid	Hatched		Moult	Instar	Moult	Instar	Moult	Instar	Moult	Instar	Moult	Instar	
Lot A (all from one egg cluster).														
1	May 20	May 25	5 days	May 28	3 days	June 3	6 days	June 5	2 days	June 13	8 days	June 26	13 days	37 days
2	May 20	May 25	5 days	May 28	3 days	June 3	6 days	June 6	3 days	June 14	8 days	June 23	9 days	34 days
3	May 20	May 25	5 days	May 28	3 days	June 3	6 days	June 8	5 days	June 17	9 days	June 23	6 days	34 days
4	May 20	May 25	5 days	May 28	3 days	June 4	7 days	June 5	1* day	June 15	10 days	June 22	7 days	33 days
5	May 20	May 25	5 days	May 28	3 days	June 4	7 days	June 1	3 days	June 19	12 days	June 30	11 days	41 days
6	May 20	May 25	5 days	May 28	3 days	June 4	7 days	June 9	5 days	June 15	6 days	June 22	7 days	33 days
7	May 20	May 25	5 days	May 28	3 days	June 3	6 days	June 9	6 days	June 17	8 days	June 26	9 days	37 days
8	May 20	May 25	5 days	May 28	3 days	June 4	7 days	June 15	11 days	June 19	4 days	June 30	11 days	41 days
9	May 20	May 25	5 days	May 28	3 days	June 1	4 days	June 6	5 days	Died				
10	May 20	May 25	5 days	May 28	3 days	June 3	6 days	June 5	2 days	June 13	8 days	June 26	13 days	37 days
Lot B (all from one egg cluster).														
1a	May 31	June 4	4 days	June 7	3 days	June 17	10 days	June 24	7 days	June 30	6 days	July 7	7 days	37 days
2a	May 31	June 4	4 days	June 7	3 days	June 17	10 days	June 24	7 days	June 29	5 days	July 18	19 days	48 days
3a	May 31	June 4	4 days	June 7	3 days	June 16	9 days	June 21	5 days	June 26	5 days	July 6	10 days	36 days
4a	May 31	June 4	4 days	June 7	3 days	June 16	9 days	June 21	5 days	June 28	7 days	July 7	9 days	37 days
5a	May 31	June 4	4 days	June 7	3 days	June 20	13 days	June 26	6 days	July 5	9 days	Died		
6a	May 31	June 4	4 days	June 7	3 days	June 13	6 days	June 20	7 days	June 26	6 days	July 12	16 days	42 days
7a	May 31	June 4	4 days	June 7	3 days	June 12	5 days	June 17	5 days	June 24	7 days	July 2	8 days	32 days
8a	May 31	June 4	4 days	June 7	3 days	June 11	4 days	June 15	4 days	June 22	7 days	June 28	6 days	28 days
9a	May 31	June 4	4 days	June 7	3 days	June 15	8 days	June 17	2 days	June 21	4 days	June 28	7 days	28 days
10a	May 31	June 4	4 days	June 7	3 days	June 18	11 days	June 29	11 days	Died				
11a	May 31	June 4	4 days	June 7	3 days	June 11	4 days	June 17	6 days	June 26	9 days	June 29	3 days	29 days
12a	May 31	June 4	4 days	June 7	3 days	June 10	3 days	June 18	8 days	Died				

*This nymph moulted in the morning of June 4th and in the afternoon of June 5th, giving about 30 hours for the third instar.

CONTROL

Natural Enemies

Many natural enemies prey upon the southern green stink-bug and often assist in keeping down the great numbers of this pest. These enemies are represented by parasites on both the adults and the eggs, by predaceous insects and by some insectivorous birds.

Parasites

The most important natural enemies are the dipterous, or two-winged, parasites on the adults. The larvae or maggots of these dipterous insects, or flies, live inside of the host during their development. Here each maggot feeds upon the tissues of the host, usually avoiding the destruction of the vital organs until it is fully matured. Then the full-grown maggot works its way out of the old carcass of its host, in all cases observed at the posterior end of the body or anal opening, and seeks shelter a little beneath the surface of the ground. In about an hour or so the outer skin of the maggot hardens into a brown case, inside of which it changes into a pupa. (The pupa is the resting or transformation state in which many insects undergo that wonderful change from larva to adult). In a few days the pupa changes into an adult fly which breaks through the brown case, or puparium, and emerges. The breeding of many dipterous parasites is quite rapid and, in the species discussed herein, there are several generations in a year.

Several hundred nymphs in each of the five different instars were collected in the field and reared in cages in the laboratory. Only a few nymphs in the fifth instar bore tachinid eggs, but no parasites were bred from these or other nymphs nor from adults which had been reared from nymphs collected in the field.

The eggs are also parasitized by small hymenopterous insects or four-winged flies.

A number of years ago adults of the southern green stink-bug, which had been killed by parasites, were reported by Franklin from Apopka, Florida, in Hubbard (1885, p. 162) who states: "The green bug has a parasite. I do not know what, but I frequently find their shells with the insides devoured out. * * *" Several years later, Morrill (1910, p. 83) states "Of 39 specimens collected by Mr. Hooker at Quincy, Fla., in stages susceptible to parasitism by tachinids, in only one instance was a tachinid egg found attached to a bug. This bug was in the fifth nymphal instar and became adult 4 days after the egg was first observed and died 10 days later, but upon dissection no evidence of the presence of an internal parasite could be found."

Family Tachinidae

Trichopoda pennipes Fabricius (Fig. 25)

This dipterous parasite was first reported by Watson (1918, p. 261) and a month later by Jones (1918, p. 22) as a common parasite on the southern green stink-bug, *Nezara viridula.* It is probably the internal parasite that had preyed upon the adults noted by Franklin in Hubbard, also which had laid the eggs noted by Morrill.

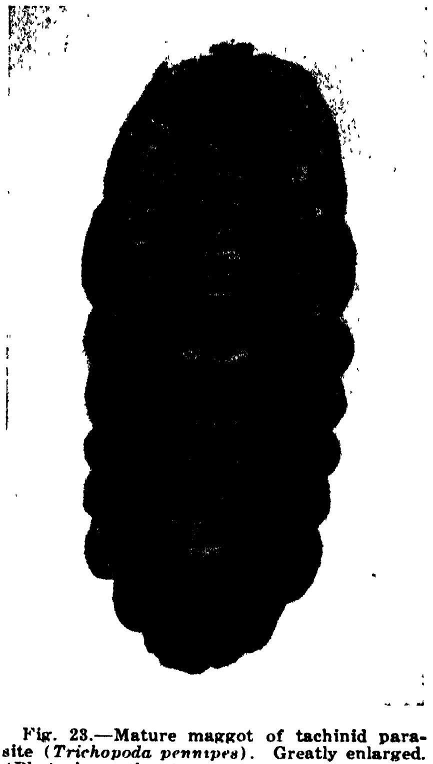

Fig. 23.—Mature maggot of tachinid parasite (*Trichopoda pennipes*). Greatly enlarged. (Photo by author.)

Undoubtedly, this tachinid fly is by far the most important enemy of the southern green stink-bug in Florida. From 10 to 80 per cent of the adults taken in the field during the summer of 1918 at Gainesville bore tachinid eggs. 800 adults, collected on radish, collard, cowpea and rattlebox during the latter part of May, June and July, were brought in from the field and placed in breeding cages in the laboratory. 38 per cent of these specimens were killed by internal parasites, and of these 31 per cent by *Trichopoda pennipes* (Figs. 23, 24 and 25). In a few cases eggs of this parasite were noted on nymphs in the fourth and fifth instars, but no parasites were reared from these nymphs. However, a few parasites were bred from adults collected in the field that bore no tachinid egg-shells, but it was impossible to determine whether the egg-shells had been dislodged before the insects were captured or whether they had been cast off with the last nymphal skin in moulting. There seems to be no reason why the larger nymphs should not be susceptible to parasitism; provided the eggs of the parasite are deposited in time to hatch and for the larvae to penetrate the body of the host before the nymphal skin is cast off during moulting.

This tachinid fly is also a parasite on many other large plant-feeding bugs. Specimens have been bred from the common squash bug, *Anasa tristis,* in New Hampshire by Weed and Conradi (1902, p. 20). Chittenden (1902, p. 25) reared it from the northern leaf-footed plant bug, *Leptoglossus oppositus* (Say). Both of these plant-feeding insects are not uncommon in Florida. In addition to the southern green stink-bug the author bred it from the following insects in Florida: The green soldier-bug, *Acrosternum* (*Nezara*) *hilaris* (Say), Gainesville, July 26 and August 10; the green stink-bug, *Acrosternum pennsylvanicum* (DeG.), Fort Myers, August 8; the squash bug, *Anasa tristis* (DeG.), Gainesville, July 20; the banded leaf-footed plant-bug, *Leptoglossus phyllopus* (Linn.) Fig. 34, Gainesville, July 15, and a large coreid, *Archimerus calcarator* (Fabr.), Homestead, July 18.

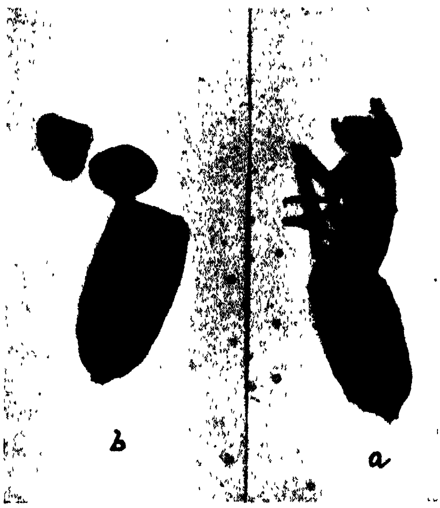

Fig. 24.—(*a*) Adult tachinid fly (*Trichopoda pennipes*) escaping from pupa case; (*b*) empty pupa case or puparium.

Quite frequently during July and August the adults of the banded leaf-footed plant-bug, *Leptoglossus phyllopus* (Fig. 34) were noticed with the eggs of this tachinid fly attached to their thorax and other parts of their body. These specimens were feeding on cowpeas that were badly infested by the southern green stink-bug. During the first week in August the eggs of this parasite were also noted on two species of the large big-footed plant bugs, *Acanthocephala femorata* (Fabr.) and *Acanthocephala declivis* (Say).

Notes on the Life History of the Parasite

The Adults.—Both the male and the female of *Trichopoda pennipes* (Fig. 25: a, male; b, female) are somewhat variable in size, ranging from about 1/3 to ½ inch in length. The general color is black with a yellowish or reddish-yellow abdomen. The thorax in front is beautifully marked with alternating lines of black and golden yellow. In some specimens the color markings on the thorax are not very distinct. The front of the head is whitish with a golden yellow stripe adjacent to the inner side of each eye. The sexes are readily distinguished by color markings.

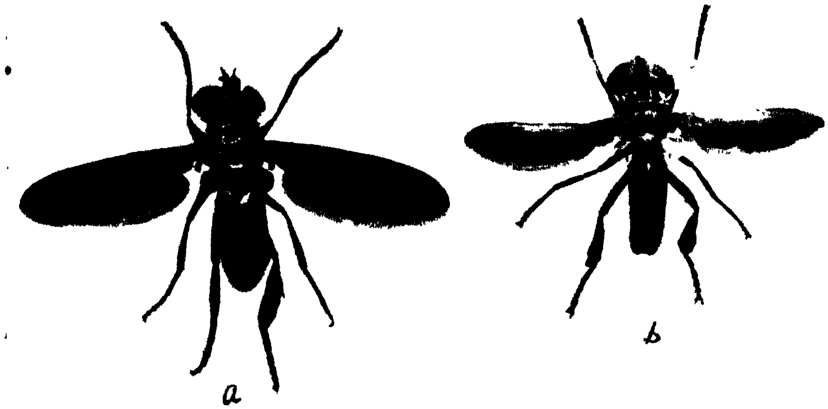

Fig. 25.—(*a*) Adult male and (*b*) female tachinid fly (*Trichopoda pennipes*). Enlarged (Photo by author)

In the male the tip of the abdomen is black and the wings are entirely black. The abdomen of the female is entirely yellowish or reddish-yellow and the wings are margined with yellowish on about one-half of the basal portion of the anterior margin. The legs are black, except a yellow basal portion, in both sexes.

This parasite is a nectar loving insect and both males and females are attracted to the blossoms of several wild plants. On bright sunny days they may be seen flying among the flowers and searching for the nectaries. Numerous specimens have been collected by the writer at Gainesville, Florida, on the flowers of the following plants: Chinquapin, *Castanea pumila* (L) Mill., a few specimens during the first and second weeks in May; basswood or linden, *Tilia americana* L., a few specimens during June; rattle-box, *Crotalaria usaramoensis* (Fig. 36), very common during July, August and September; Angelica tree, *Aralia spinosa* L., numerous specimens during July and August; pepper-vine, *Cissus (Ampelopsis) arborea* (L) thoroughwort, *Eupatorium* sp., common during October and November (Watson).

The blossoms of rattle-box, *Crotalaria usaramoensis,* seem to exert the greatest attraction to this parasite and many specimens were noted visiting the flowers during July, August, and September. A number of the parasites were captured while they were visiting the bloom of rattle-box, and the contents of their digestive organs studied in the laboratory. In some specimens the entire alimentary canal was removed and the contents studied by means of the compound microscope. In other specimens the contents of the digestive organs were washed out in water and tested for sugar by means of Fehling's solution. No pollen grains were observed under the microscope, but Fehling's solution showed the presence of sugar. The contents of the alimentary canal were not studied for other flowers.

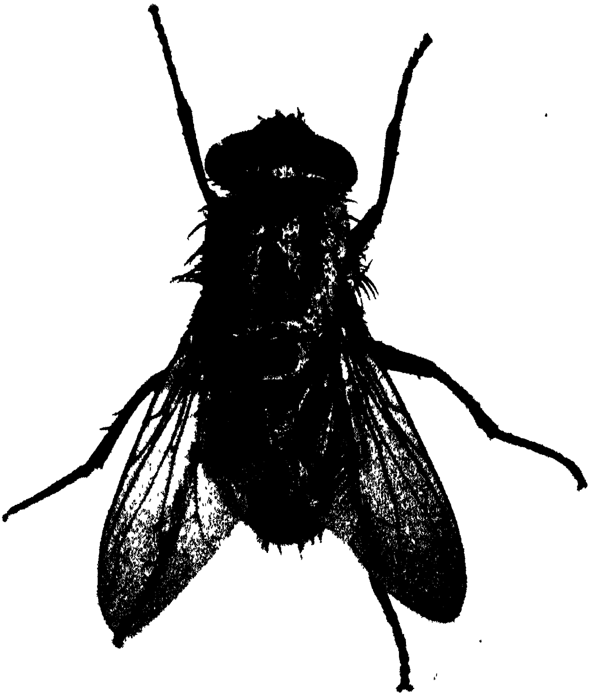

Fig. 26.—Adult sarcophagid parasite (*Sarcophaga sternodontis*). Much enlarged. (Photo by author).

Distribution.—This parasite, no doubt, occurs throughout the entire state of Florida. Johnson records the species from St. Augustine, Georgiana (July), Lakeland (May 6) and Charlotte Harbor (January and April.) The author bred many specimens from insects at Gainesville, also from specimens sent in from Fort Myers and Homestead. According to the records cited by Aldrich (1905, p. 425) this Tachinid fly occurs in the West Indies, Mexico, and Eastern United States (Grinsby, Canada to Florida; Florida to southern California).

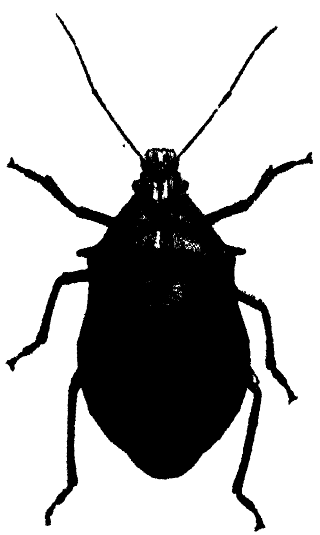

Fig. 27.—The Florida predaceous bug *(Euthyrhynchus floridanus)*. Enlarged. (Photo by author.)

During copulation both sexes face in the same direction, the male being uppermost. The process closely resembles that of the ordinary house-fly. Mating usually takes place while the pair is resting on some foliage, but in one instance a pair was observed on the wing with both sexes actively flying (hovering) near the flowers of rattle-box. The period of duration, as timed in the breeding cages, was found to vary from about one to twelve minutes. Observations show that coition is repeated several times, even during the egg-laying period.

The egg (Fig. 21) is ellipsoidal in form, the attached side being flat and the opposite strongly convex. The outer surface is glistening and minutely sculptured with traces of hexagonal markings. It is about 1/45 inch in length and 1/70 inch in width. At the time of deposition, the egg is whitish in color, but it soon changes to a darker or grayish hue. A gluey liquid accompanies the egg which quickly hardens in the air and firmly glues the egg to the body of the host. The eggs are laid singly, only one egg being placed at a time on the host. However, there seems to be no discrimination as to where the egg is placed on the body; and a female will not hesitate to deposit an egg on a bug that already bears one or more tachinid eggs. Most of the adults in the field bore only one tachinid egg, but it was not uncommon to find two, three, four or even five eggs on a single individual. Where the flies were rather numerous, I have found as many as eight eggs upon a single host.

The number of eggs on a bug seems to depend largely upon the number of times a female tachinid fly, either the same female or other females, happen to come in contact with the body of the bug. This was nicely illustrated in the breeding cages. On July 15 a pair of tachinids was placed in a breeding cage containing twelve reared adults of *Nezara viridula.* During the afternoon the female deposited eggs as follows: No eggs on two bugs, one on two, three on one, four on two, and five on two. Both male and female died during the following night; upon dissection 17 eggs in various stages of development were found within the body of the female. Although this gives a total of 46 eggs; it probably does not represent the entire number of eggs laid by this female as she may have deposited several eggs before the pair was collected in the field (62 eggs have been found in the body of a single female that was taken in the field while depositing eggs). In other breeding cages several pairs of *Trichopoda pennipes* were confined with numerous reared specimens of the southern green stink-bug. In all cases the tachinid flies were taken while copulating in the field. In depositing an egg the female tachinid, as she crawls over a bug, quickly lowers the tip of her abdomen and places an egg on the bug. The bugs seem to pay no attention to the tachinids. In fact their presence does not seem to disturb or annoy them at all. In one cage 22 eggs were deposited on a single specimen of *Nezara viridula* (Fig. 21), 16 being on the dorsal surface of the body. In the field and in the breeding cages eggs have been deposited upon the eyes, legs, head, thorax, wings, abdomen, and ventral surface of the body of the host. The location of the egg seems to depend upon where the female parasite chances to pass over the host. Neither the female tachinid nor the host pays any attention to the eggs after they have been deposited.

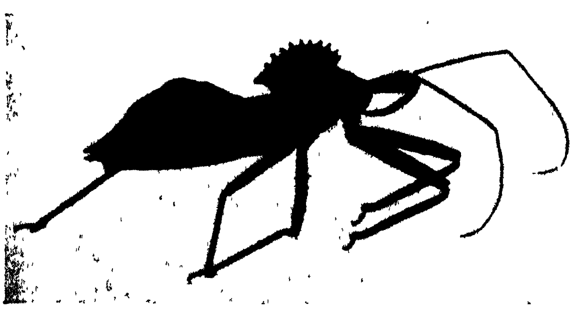

Fig. 28.—The predaceous wheel-bug (*Arilus cristatus*). Enlarged. (Photo by author.)

Upon hatching the minute young maggot makes a very small hole through the flat or attached side of the egg into the host. In figure 22 the egg shell has been removed to show the hole through the exoskeleton made by the tiny maggot in entering the host. This hole is greatly enlarged in the picture. No other hole or opening, except one through the attached side of egg-shell, is made by the maggot in escaping from the egg. The maggot or larva lives, feeds and grows on the inside of the host until it is full-grown. The mature maggot then works its way out of the body of the host at the posterior end of the abdomen and buries itself in the ground. The host dies a little before or soon after the mature maggot leaves its body. The incubation of the egg and the development of the maggot within the body of the host required from 17 to 24 days. Eggs have been observed to hatch in two or three days. Eggs of this tachinid fly have been observed on *Nezara viridula* during the months of April, May, June, July, August, September, October, November and December. The adult flies have also been seen in the field during these months and March at Gainesville. No records have been made during the other months.

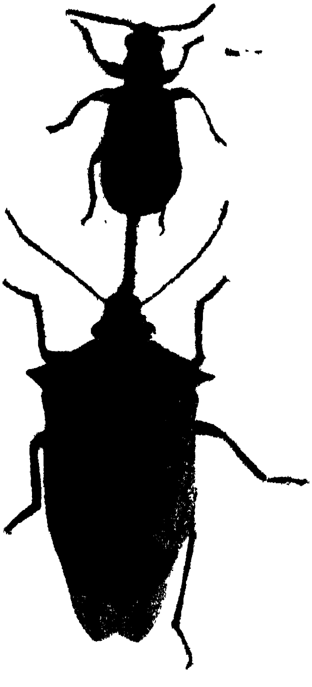

Fig. 29.—The spined soldier-bug (*Podisus maculiventris*) killing a beetle. Enlarged. (Photo by author).

The mature larva or maggot (Fig. 23) is light yellowish white in color and varies from about ⅜ to ½ inch in length. After descending into the soil the maggot prepares for the transformation into the winged fly. It contracts slightly, assumes a regular ovoid shape, and forms a pupacase or puparium in a very short time. When placed in a glass vessel and forced to pupate under aerial condition, the larva would crawl about for a time seeking suitable conditions to pupate. However, after crawling about for an hour or two the larva will transform to the pupa state in the open. The puparium or pupa-case is nearly smooth, ovoid in outline, brown in color and a little shorter than the mature maggot. Within the pupa-case or puparium many complicated changes take place during which legs, wings, eyes, hairs, mouthparts, and other structures of a winged fly slowly make their appearance. The pupa stage lasts from eleven to thirteen days, twelve days being the average time. When fully formed, the mature tachinid fly (Fig. 25) by means of dilations of its face, pushes off the lid-like portion of the anterior end of the puparium (Fig. 24) and in a similar manner works its way up through the soil. In about a half hour or a little longer the body is entirely hardened, the wings fully expanded, and the color markings fixed to that of the adult. It is rather interesting to note that the emergence of this parasite as well as that of the other dipterous parasites generally took place in the morning, principally between eight and ten o'clock.

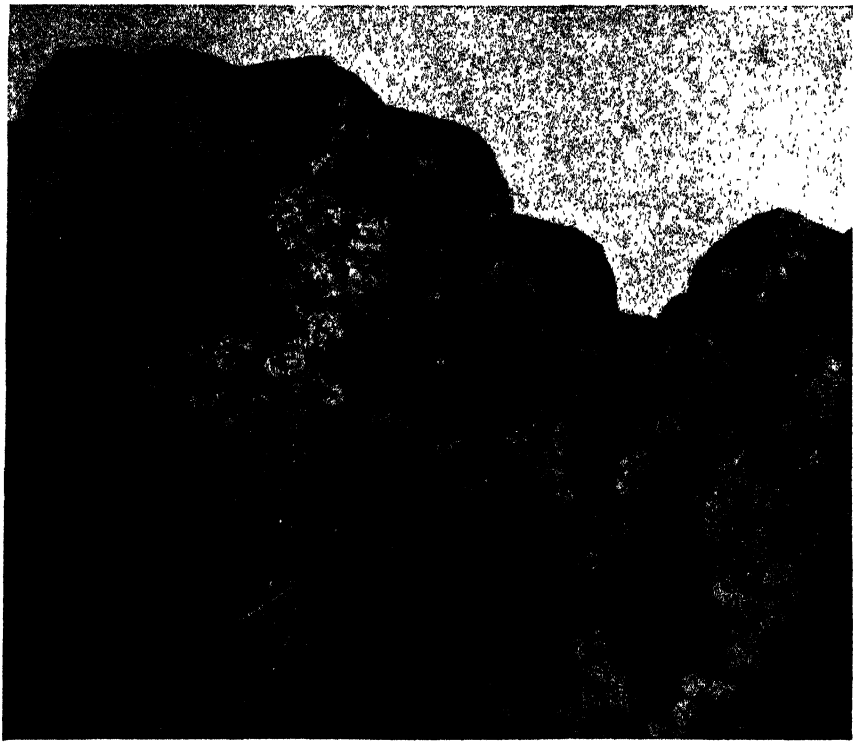

Fig. 30.—The harlequin cabbage-bug (*Murgantia histrionica*) feeding on collard leaf. Note large whitish areas caused by feeding. Slightly enlarged. (Photo by author).

Only one mature maggot of *Trichopoda pennipes* (Fig. 23) was bred from a single host, even when the host bore a number of the eggs of the parasite.

Trichopoda lanipes Fabricius

Only one example of this tachinid fly was reared during the summer. It was bred on August 8th from a specimen of the southern green stink-bug, *Nezara viridula,* that had been sent in from Fort Myers, Florida. The species can readily be separated from *Trichopoda pennipes* by its entirely black legs and abdomen.

This tachinid fly is rather common in the vicinity of Gainesville and it is also attracted to the blossoms of wild flowers. Prof. P. W. Fattig and the author captured a few specimens while they were flying among the flowers of the angelica-tree, *Aralia spinosa* L., and the pepper-vine, *Cissus arborea,* during the latter part of July and August. Prof. Watson collected it on basswood blooms in May. No specimens were reared from insects collected at Gainesville.

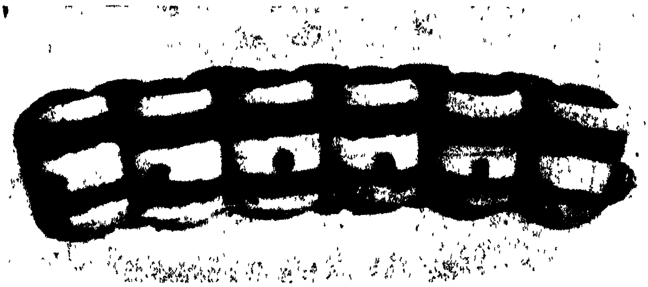

Fig. 31.—Lateral view of the eggs of the harlequin cabbage-bug (*Murgantia histrionica*). Greatly enlarged. (Photo by author)

Family Sarcophagidae

Sarcophaga sternodontis Townsend (Fig. 26)

In general appearance and size this two-winged parasite very much resembles the omnipresent house-fly. It ranks next to the tachinid fly, *Trichopoda pennipes* (Fig. 25), as a natural enemy of the southern green stink-bug, about six per cent of the adults being killed by this parasite at Gainesville. As in the other parasites, the larva or maggot lives within the body of the host and feeds upon the internal tissues of the host throughout its development. When fully matured, the maggot crawls out of the posterior end of the abdomen and seeks shelter a little beneath the surface of the ground to pupate. Usually, only one maggot lives within the body of the southern green stink-bug, but in a few cases two maggots were reared from one specimen. In larger insects a number of maggots often live within the body of the same host at the same time, three being reared from one specimen of a large coreid (Fig. 33), *Corecoris confluenta* (Say), in the last nymphal instar and twenty-six from four specimens of the large lubber-grasshopper. When two or more maggots live within the body of one host, they mature at the same time; this seems to indicate that they are practically of the same age.

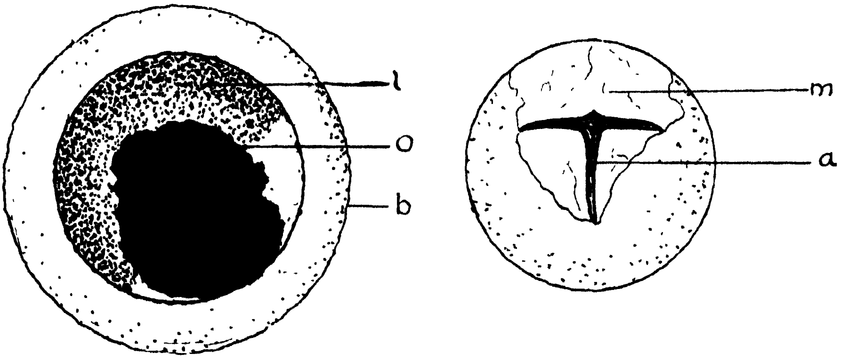

Fig. 32.—Dorsal aspect of eggs of harlequin cabbage-bug: *l*, lid, or cap; *b*, outer wall or barrel of egg-shell; *o*, opening made by egg-parasite through lid in escaping from egg-shell; *a*, egg-burster used by nymph in opening lid of egg-shell; *m*, membrane. (Drawn by Wessel.)

The full-grown maggots usually leave the body after the death of the host, the time varying from one to six days. Occasionally, a mature maggot has been observed to crawl out of the posterior end of the abdomen a few hours before the death of the host. The full-grown maggot is dirty grayish white in color and about three-eighths of an inch in length. The pupa case or puparium is a little shorter than the mature larva, nearly smooth, reddish brown in color, and ovoid in form. The pupa state lasts from seven to ten days, eight days being the average time. When fully formed, the adult fly, by inflating the ptilinum, pushes open, or off, a lid-like portion of the anterior end of the puparium, works its way out of the opening thus formed, and then up through the ground. In a remarkably short time, usually within a half hour, the wings are wholly expanded and the body perfectly indurated.

According to Aldrich (1905, p. 514) this sarcophagid has been bred from a cerambycid beetle, *Sternodontis damicornis*, and from a scorpion, *Centurus edwardsii*, in Jamaica, West Indies. In Florida, Aldrich (1916, p. 267) states that it has been reared from the American locust, *Schistocerca americana;* the large lubber-grasshopper, *Dictyophorus reticulatus;* and the larva (hickory horned devil) of the regal moth, *Citheronia regalis.* In addition to the many records of specimens bred from the southern green stink-bug, the author has reared the parasite from the following insects in Florida: The northern green soldier-bug, *Acrosternum hilaris* (Say), 3 specimens, Gainesville, June 10; the harlequin cabbage-bug, *Murgantia histrionica* (Hahn) (Fig. 30), 5 specimens, Gainesville, June 20 and 21; the brown stink-bug, *Euschistus servus* (Say), 6 specimens, Bulow, June 12 and 1 specimen, Gainesville, June 27; a very large coreid, *Corecoris confluentus* (Say) (Fig. 33), 4 specimens from two nymphs, Homestead, July 26, and the large lubber-grasshopper, *Dictyophorus reticulatus* (Thumb), 26 larvae from 4 adults, Putleta, July 28.

Other Dipterous Records

One specimen of *Muscina stabulans* Thumb (family Muscidae) and several specimens of *Fannia femorata* Lw. (family Anthomyiidae) were reared from several dead specimens of the southern green stink-bug on June 15. My records seem to indicate that both of these flies are scavengers instead of parasites. The cover of the glass breeding cage had been accidentally removed and it seems that in all probability the specimens became infested after death. No examples of either of these species were bred from other breeding cages or living hosts. A little humpbacked fly, *Phora scalaris* Loew, was found breeding in dead specimens which had been placed in waste jars; it was also noted breedin decaying vegetation.

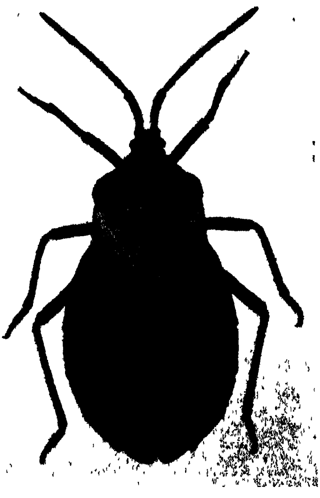

Fig 33—A large plant-feeding bug (*Corcocoris confluentus*). *Slightly* enlarged. (Photo by author).

Egg Parasites

Occasionally, the eggs of the southern green stink-bug are parasitized by minute four-winged insects that are commonly known as chalcid flies. They belong to the superfamily Chalcidoidea of the order Hymenoptera.

The female egg-parasite, with the aid of her ovipositors, makes a tiny hole through the shell of an egg (host) and then, through the opening or hole thus formed, places one of her own eggs on the inside. Here her egg hatches and the young maggot-like larva, feeding upon the contents of the egg, lives and grows until it is fully matured. Pupation also takes place within the egg-shell. In a very short time a minute four-winged fly is formed within the pupa case. This fly works its way out and escapes from the egg or host by eating an irregularly-shaped hole thru the cap or disc-shaped lid (Fig. 16). In all cases observed the mature egg-parasites emerge after the non-parasitized eggs have hatched.

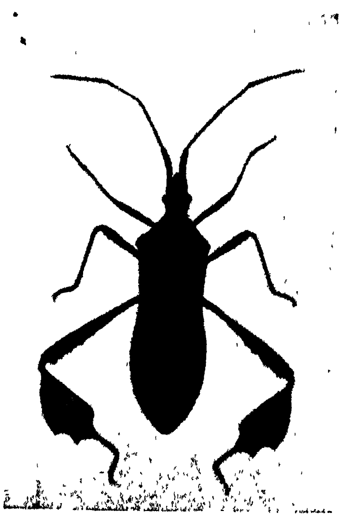
Fig. 34.—The banded leaf-footed plant-bug (*Leptoglossus phyllopus*). Enlarged. (Photo by author).

During the last two weeks in May and the first week in June, 40 egg clusters of the southern green stink-bug were removed from the leaves of radish and collard in the field and placed in small, low stender dishes with ground glass covers. In most cases a small portion of the leaf was removed with the egg cluster so as not to injure or destroy any of the eggs. The eggs were in various stages of development, many of the clusters being almost ready to hatch. These 40 clusters contained 3544 eggs, averaging a little better than 88 eggs to a cluster. 3 mature parasites were reared from these eggs and 581 of them failed to hatch or over 16 per cent of the total number of eggs failed to develop. Of the 581 eggs, most of them seemed to be unfertile, a few contained parasites that failed to escape, and several contained nymphs that died just before hatching. On the other hand, some of the eggs may have been destroyed under the artificial conditions in the insectary. However, it was not at all uncommon to find several eggs in a cluster that had failed to develop outdoors under natural conditions. The 3 mature parasites were determined by Mr. Gahan of the United States Department of Agriculture as a new species belonging to the genus *Ooencyrtus* of the family *Encyrtidae.*

Many other egg clusters were incubated in the insectary or examined in the field after hatching, during the summer, and only two others showed evidences of egg-parasites. A cluster of 95 eggs, found on the underside of a cowpea leaf, about the middle of July, a few days after hatching contained four eggs with the characteristic hole or opening (Fig. 16) of the parasites in the lid and 14 eggs that had failed to incubate. The other egg cluster was removed from the underside of a leaf of rattle-box (Crotalaria) a few days after deposition and the incubation period completed in the insectary. Out of the 99 eggs in this cluster, 12 mature parasites were reared and the rest of the eggs were all fertile and hatched perfectly. As these 12 egg-parasites were all males, Mr. Gahan states that it is impossible to give even a generic name for them, but that they belong to the Chalcidoid subfamily Eupelminae.

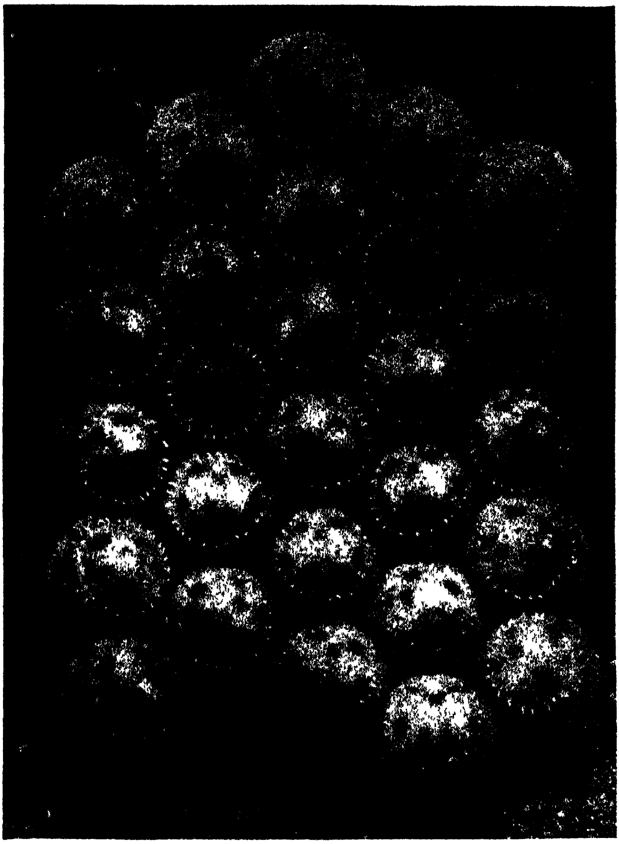

Fig. 35.—Eggs of the brown plant-feeding stink-bug (*Euschistus servus*) on an orange leaf. Greatly enlarged. (Photo by author).

According to Morrill (1910, p. 82) and Whitmarsh (1917, p. 542) the eggs of the northern green soldier-bug, *Acrosternum hilaris,* are frequently parasitized by a proctotrypid parasite. To quote from Whitmarsh: "These small black fly-like parasites are most noticeable in mid-July, or at the time when the pentatomids are at the height of the egg-laying season." This egg-parasite was determined by Girault as belonging to the genus

Fig. 36.—A trap and propagating plant (*Crotalaria usaramoensis*). The plant attracts the southern green stink-bug (*Nezara viridula*) and the blossoms attract the most important parasite (*Trichopoda pennipes*). On station grounds at Gainesville. (Photo by Thompson).

Trissolcus, probably *euschisti* Ashmead. Girault (1907, p. 30) lists *Trissolcus eusrhisti* as an internal parasite upon the eggs of three brown stink-bugs, *Euschistus servus* (Fig. 35), *E. tristigmus* and *E. fissilus* (*euschistoides*). The first two species are very common plant-feeding insects in Florida.

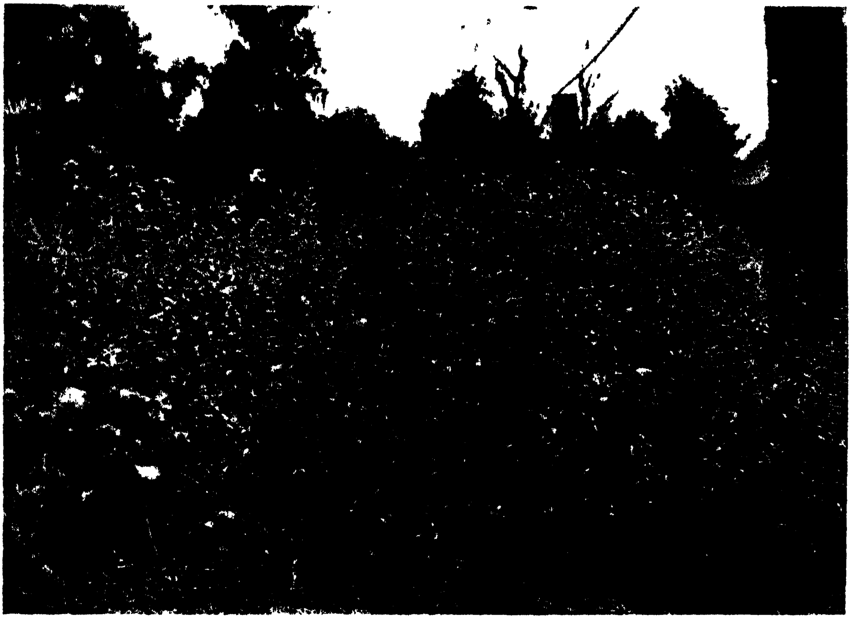

Fig 37.—Radish plants bearing pods. Radish and collard make a good trap crop to protect tomatoes. (Photo by author).

During the months of July and August the author found that from five to ten per cent of the eggs (Fig. 31) of the harlequin cabbage-bug were destroyed by two internal parasites, *Trissolcus murgantiae* Ashmead and *Ooencyrtus johnsoni* Howard. The eggs of the southern green stink-bug, when removed from the same plant (collard) or plants growing in the same patch, failed to show any evidences of either of these parasites.

Trissolcus podisi has also been reared from the eggs of the Harlequin cabbage-bug by Morgan in Louisiana and Mississippi.

Identification of Parasites

The reared parasites or mature forms were turned over to specialists for identification. At this opportunity the writer wishes to express his appreciation to Prof. Jas. S. Hine, Ohio State University, Columbus, Ohio, for the determination of the Diptera. The Sarcophagidae were forwarded by Prof. Hine to

Dr. J. M. Aldrich, National Museum, Washington, D. C., for identification. Through the courtesy of Dr. L. O. Howard, Mr. A. B. Gahan has very kindly determined the egg-parasites.

Predaceous Insects

Several predaceous insects prey upon the southern green stink-bug in Florida. These consist of two predatory pentatomids, three assassin-bugs or reduviids and one large wasp.

Euthyrhynchus floridanus (Linn.), the Florida predaceous bug (Fig. 27).

This is the most important predatory enemy of the southern green stink-bug, numerous records being made by the writer during May, June, July and August in the field. In most cases the predator had impaled a mature victim on its beak, the beak usually penetrating the dorsal portion of the thorax. The Florida predaceous bug is also an important enemy of many other plant-feeding insects, including the velvet bean caterpillar, and should not be destroyed.

Podisus maculiventris (Say), the spined soldier-bug (Fig. 29).

Altho very common in the fields, only two instances of this insect feeding upon the larger nymphs of *N. viridula* were noted. Jones (1918, p. 22) found it preying upon a nymph in the fifth instar in Louisiana.

Arilus cristatus (Linn.), the wheel-bug (Fig. 28).

This is another insect that preys on the southern green stink-bug. Two large nymphs of the wheel-bug were found feeding upon specimens of *N. viridula* in the fourth and fifth nymphal instars during the latter part of May. The wheel-bug is so called because of a prominent, semicircular, toothed ridge on its thorax which greatly resembles a half cogwheel.

Sinea spinipes (H. S.) and *Zelus cervicalis* Stal., assassin-bugs.

An adult of each of these assassin-bugs was found on *Amaranthus* sp. with its beak piercing the body of a nymph in the second instar.

Bicytes quadrifasciata Say, a large bembecid wasp.

According to Jones (1918, p. 23) "Mr. S. A. Rohwer of the Bureau of Entomology states that a bembecid wasp which Mr. Russell collected at St. Leo, Fla., October 22, 1907, belongs to this species. The specimen was taken while in flight with an adult of *Nezara viridula* in its mandibles."

Birds

The food habits and stomach contents of many American birds have been carefully studied by the United States Biological Survey and others to determine their economic status in various parts of the country. The malodorous bugs, including the ill-flavored and strong-scented stink-bugs, have been found to constitute a part of the food of a number of birds. Among these birds might be mentioned the quail, the blackbird, the crow, the swallows, the flycatchers, the thrushes, the robin, etc. The northern green soldier-bug, *Acrosternum hilaris* has been found in the stomach of the quail, the robin, the cliff-swallow, the crested flycatcher and other birds. In Porto Rico, Wetmore found *Nezara* sp. in the stomach of a number of different birds. Numerous similar records have also been published for the United States.

In regard to the southern green stink-bug, *Nezara viridula,* Watson (1918b, p. 232) states "In spite of the bad smell birds occasionally eat these bugs." Chickens have also been noted by Watson (1918c, p. 90) as feeding upon this pest. During July, the writer placed a number of nymphs on the twigs of young orange trees. On the following morning a number of these twigs were without insects, probably being destroyed by birds.

A letter from Prof. Watson (Dec. 1919) states that he finds that mature chickens are very fond of the southern green stink-bug, especially after they are taught to eat them. This can readily be done by throwing a few stink-bugs to a flock of chickens which are confined. If chickens are allowed to run through a field they can be depended upon to keep the bugs down, particularly in the late fall when the bugs are usually more troublesome. Of course chickens are a nuisance in a truck patch and this remedy will have to be conducted with some discretion. This is accomplished by giving the chickens all the green stuff they will eat before turning them loose in the garden, and then only for an hour or two before roosting time so that they will not have much time to wallow. Where young chickens can be allowed to run over the garden and the old hen confined, it is much more satisfactory from the standpoint of growing vegetables. Take a coop full of chickens and move them, old hen and all, to the center of the infested area, open the coop leaving out the chickens, but keeping the old hen confined. However, the young chickens have to be of fairly good size before they will be very efficient catchers of the adult insects.

Climate

Climate is often considered an important factor in the control of economic insects. In Louisiana, Jones (1918, p. 23) found that specimens of the southern green stink-bug, especially nymphs, are sometimes killed by low temperatures during the winter months in the insectary; he also states that a sudden drop in temperature during this season of the year often kills individuals in the field and gives specific cases for Florida and Texas. At Gainesville, Prof. Watson states that he has never seen many adults that were killed by cold weather, but, although they sometimes find dead specimens during the winter, a careful examination of their bodies generally shows signs of parasitism. He believes that the disappearance of this insect during the winter months is due largely to stoppage of breeding, to work of parasites and to hibernation. Of course, there is undoubtedly a natural mortality (probably higher) during winter as in other seasons of the year. About one-half of the individuals seek favorable places to hibernate during cold weather and this probably accounts for the paucity of numbers often noted by growers during the winter, especially in the central and northern parts of the state.

On the whole it seems that the bioclimatic factors, as climate, weather, sunshine, topography, latitude, altitude, etc., have been well suited for the propagation and dissemination of the insect in Florida. The mild winters do not, at least, kill great numbers of the pest and it is not uncommon for serious outbreaks during early spring and summer upon cultivated plants, especially tomatoes, potatoes, beans, peas, etc.

ARTIFICIAL CONTROL

Clean Culture

There are a number of wild plants or weeds upon which the insect feeds and breeds, especially during early spring and late fall. Volunteer plants should also be classified as weeds. The preferred food plants, both wild and cultivated, belong largely to the legumes or Pulse family (Leguminosae) and to the mustard family (Cruciferae). The individuals that do not seek favorable places to hibernate during cold weather generally remain upon some member of the mustard family throughout the entire winter. Weeds and volunteer cultivated plants should be kept down at all times, not only in cultivated field, but in other fields and waste places. The destruction of these plants will keep down the food supply, kill many immature forms and shorten the breeding season. The remnants of field, truck, garden and cover or soiling crops should be scrupulously destroyed after the crop is harvested so as to stop breeding and destroy immature forms.

A leguminous cover or soiling crop, as beggarweed, cowpeas, etc., is generally grown during the summer in both citrus and pecan groves, the crop to be cut or turned under later on. The proper management of this cover crop upon which the insect breeds is a potent factor in controlling the pest upon either citrus or pecan trees. As stated by Watson (1917a, p. 60R) the beggarweed or cover crop should be cut with a scythe in the rows and from around the trees first, leaving the middles between the rows of trees to be cut a few days later, but not later than September 15. The immature forms will then work away from the trees to the uncut legumes, and, when the middles are cut a few days later, most of them will die before they can crawl back to the citrus or pecan trees. The cover crop should never be left to stand until fully matured, either in the entire grove or in the rows with the trees. Mature plants are unattractive to the insect and, as a rule, the insect can be kept down to a large extent by a proper cutting of the cover crop at the right time.

Trap and Decoy Crops

Of the long list of food plants field observations show that the adults prefer and are attracted largely to leguminous and cruciferous plants. To a large extent the preferred food plants can be classified into seasonal food plants, thereby giving the trap or decoy crop to use during the different seasons of the year. The leguminous plants, as cowpeas, beggarweed, rattle-box, beans, etc., are greatly preferred during late spring, summer and early fall; while cruciferous plants, as radish, rape, collard, mustard, turnip, etc., are attacked mostly during early spring and late fall. Adults that do not seek suitable places to hibernate during cold weather usually overwinter on the leaves of cruciferous plants, as Essex rape, radish, collard, mustard, etc., growing in the fields and waste places. No feeding takes place, except during the warmest hours of warm days, in the winter. Radish (Fig. 37) interplanted with collard seems to be the best trap crop to protect tomatoes. Radish and collard, planted about the first of November, has proven very attractive to the bugs during the tomato season of the following spring; in fact so attractive that tomatoes growing in adjoining rows or the same patch were not or scarcely at all infested. The bugs on the trap crop should be gathered by hand picking during the tomato season and both trap crop and remnants of tomato crop destroyed after the tomatoes are gathered and thus stop further breeding and destroy immature forms.

Leguminous plants are most alluring to the bugs during the pod formation period. Hand picking is undoubtedly the best method to use in gardens and truck patches for the control of the insect upon beans, peas, etc. The proper management and cutting will usually keep the pest under control where leguminous cover or soiling crops are grown. There is, of course, an overlapping of the seasonal food plants, especially during fall and spring.

Rattle-box (Fig. 36), *Crotalaria usaramoensis*, seems to offer the greatest possibilities as a trap crop for summer and fall until killed by frost. Rattle-box, or butcher-rattle, as it is sometimes called, is an herbaceous leguminous plant used in Java, East Indies, for green manuring. Two ounces of seed were received by the United States Department of Agriculture, December 26, 1917, from Buitenzorg, Java. Part of this seed was forwarded to the Experiment Station, Gainesville, Florida, during the latter part of March and planted on the station grounds on April 6, 1918. The plant is unknown to most growers in the state. Through the kindness of Prof. J. B. Thompson, Forage Crop Specialist, the following notes on rattle-box have been turned over to the writer. *Crotalaria usaramoensis* is an erect growing herb measuring from four to six feet in height with a lateral spread of three feet or more. It makes a very dense leafy growth while a profusion of bright yellow, pedicillate flowers borne on long terminal racemes gives it added ornamental value. Flowering plants may be produced in from eight to ten weeks from the seed, which may be planted as early in spring as desired after the dangers of frost are past. As an ornamental plant its value is greatly enhanced by its free blooming habits and a long blooming period that lasts all summer and is only ended by a killing freeze. It would probably succeed in winter in the southern part of the state wherever frost does not occur. This species is adapted to a wide range of conditions, but will thrive best on light fertile soil; and it delights in a warm location with plenty of sunshine. It is a splendid subject for planting where a quick-growing, temporary, ornamental hedge is desired. It also offers promising possibilities in farm practice for planting as a cover or soiling crop and for soil improvement purposes.

The ever-blooming and the long pod forming period adds greatly to the value of rattle-box as a trap crop. At Gainesville during the past summer (1918) the plants, from seed sown on April 6, began blooming during the early part of June and continued to blossom profusely until killed by a frost on December 28. The plant forms pods and seeds freely during July, August and September, but seeded very little after cool weather set in. Rattle-box is probably not more attractive, if as much so, than cowpeas and beggarweed, but the period of greatest attractibility to the insect is very much longer than that of other legumes on account of the extremely long period of pod formation. Like other legumes, rattle-box is not especially attractive to the bugs after the fruiting period, especially late fall.

As a trap crop rattle-box serves a twofold purpose. The blossoms exert a special attraction to many flower-visiting insects. Among these flower-visiting insects are numerous dipterous parasites, including the most important parasites of the southern green stink-bug. The tachinid fly, *Trichopoda pennipes* (Fig. 25) is a honey-loving insect and both male and female are much attracted to the blossoms of rattle-box for the nectaries. The long period of inflorescence, blooming continually and profusely from about ten weeks after seed is sown until killed by frost, is much in favor of rattle-box for attracting nectar-feeding parasites. The sarcophagid fly, *Sarcophaga sternodontis* (Fig. 26) and the tachinid fly, *Trichopoda lanipes*, both parasites of the southern green stink-bug, were not uncommon visitors to the flowers of rattle-box. Several other dipterous parasites were also noted.

Rattle-box should be grown as a propagating plant for parasites. The percentage of individuals of the southern green stink-bug that bore tachinid eggs was greater on rattle-box during the pod formation period than that of cowpeas and other leguminous plants during the fruiting season. This is readily explained by the fact that both blossoms and seed-pods are formed continuously during the summer, the blossoms attracting the parasites and the pods attracting the stink-bugs. The principal parasite, *Trichopoda pennipes* (Fig. 25) could always be found flying among the flowers on warm sunny days favorable to the insects.

Of 161 adult bugs collected on rattle-box, August 10, 1918, by Prof. Thompson and the writer, 110 or a little over 66 per cent bore eggs of the tachinid fly,*Trichopoda pennipes*. On August 12 all bugs were again collected on the same plot (Fig. 36) ; out of 71 specimens, 57 or slightly more than 80 per cent bore eggs of the same tachinid parasite. The last record was the highest one taken during the summer. Most of these stink-bugs bore only one tachinid egg, but it was not uncommon to find two, three, four or even five on one individual. On account of the high per cent of parasitism the southern green stink-bug should not be collected on rattle-box and destroyed by hand picking. The destruction of the bugs will destroy the parasite. Rattle-box could be

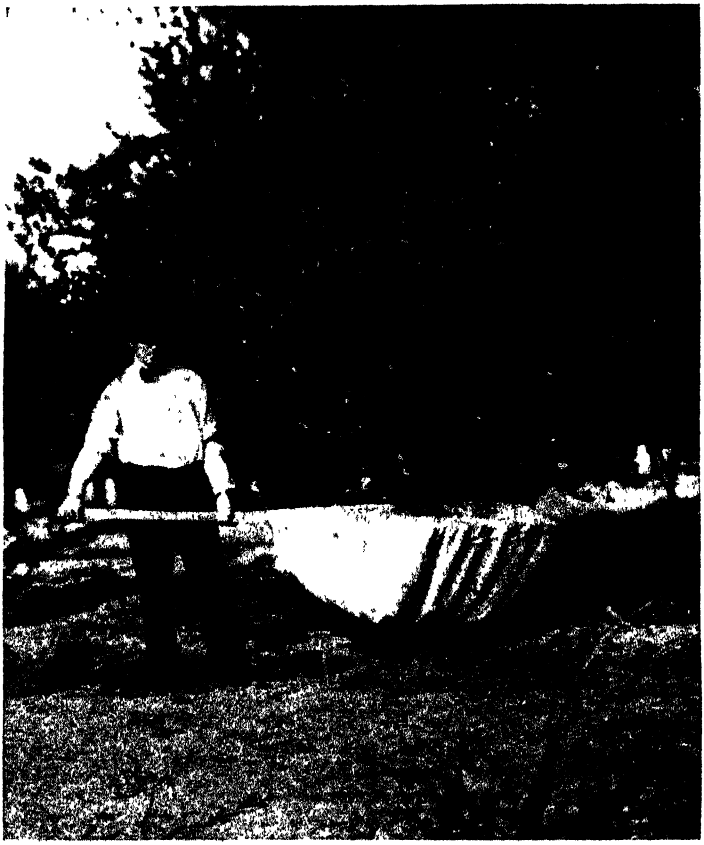

Fig. 38.—Method of hand collecting on citius trees. (Photo by Watson).

grown in plots as a propagating plant and thus increase the number of parasites.

Hand Collecting

The habit of the insect, when suddenly disturbed or when a limb is jarred, of dropping makes hand collecting profitable where valuable garden and truck crops are infested, also when citrus fruits are attacked. As the bugs are rather sluggish during cool weather, they should be gathered in early morning, or on cool or rainy days. The temperature should not be above 70° F., but a lower temperature, of course, would be much better. On potatoes, tomatoes, beans, peas, etc., the bugs should be brushed or jarred into a wide-mouthed collecting pan (preferably one with a handle) containing about an inch of water covered with a film of kerosene. The egg clusters should also be destroyed.

On citrus trees Watson (1918, p. 233 and 234) has demonstrated that the bugs can be collected economically when they are destroying the fruit or injuring young trees. For collecting the bugs on trees large nets (Fig. 38) of at least three feet in diameter and of about an equal depth were constructed. These nets should be made out of heavy muslin or preferably, good canvas.

"Each net should have a short handle which if extended across the diameter to stiffen the opposite rim will permit the use of telephone wire to complete the skeleton for the net. Bend the wire into a loop and nail the loose ends to a wooden handle.

"One man can manipulate this net, but two may work to better advantage. One places the net under a limb of fruit and the other gives the branch a quick, vigorous shake which causes the bugs to roll into the bottom of the net. After the men have finished a tree the bottom of the net is dipped in a bucket containing kerosene. This keeps the net constantly wet with kerosene.

"The work cost in one grove of ten-year-old trees set 20 by 30 feet between 50 and 75 cents an acre, and from 30 to 100 bugs a tree were collected. Two men with a net covered at least an acre in two hours.

"The labor cost $1.50 a day for each man. This is less than the cost of spraying even if a safe and effective solution were known. On larger trees with more bugs the cost is greater, but should in no case exceed $1.50 an acre,—still much less than the cost of spraying.

"For large trees not too close together and with few limbs touching the ground to prevent a ready manipulation, the nets should be larger. The writer (Watson) has used some nets 6 by 12 feet. These were suspended from a light wooden frame like those used for holding quilts or stretching curtains, the net sagging two or three feet in the center. The net should be of closely woven canvas so that insecticide oil, crude oil or kerosene can be placed in the bottom, into which the bugs will fall. Cotton waste placed in the net will absorb the oil and in rolling around will thoroughly wet the bugs. Two men will be required to manipulate the net and at least another to shake the branches.

"For large trees these nets will be found more economical than the smaller ones strung on telephone wire. They are effective, however, only at a temperature below 70 degrees. Above that the bugs will take to wing as they drop, before they strike the canvas. The use of the large nets is therefore restricted to the very early morning, to moonlight nights and to cold days. The smaller nets can be used all day, though more effectively in the early morning."

Spraying

Both Watson (1918a, p. R59-R62) and Jones (1918, p. 23-25) have demonstrated that it is not practical to use contact insecticides as a solution strong enough to kill the insect will injure or destroy the plants. Experiments with kerosene emulsion and nicotine sulphate gave negative results. A solution that will not injure the foliage of plants will not destroy all of the younger nymphs and has very little or no effect upon the larger nymphs and adults.

Nymphs and adults are both quickly killed when sprayed with pure kerosene. Badly infested weeds and remnants of cultivated plants should be destroyed, either by cutting or spraying. If the insects are mostly in the adult state, the latter method should be used.

SUMMARY

A large green stink-bug, *Nezara viridula* Linn., often becomes a serious pest upon cultivated plants in Florida. Its depredations are also well known in other southern states, but particularly in the Gulf States. The insect is of foreign origin and is almost universally distributed throughout the tropical and neotropical regions of the entire world. Its ravages have also been reported in Australia, India, West Indies, Austria and other countries.

Both nymphs and adults obtain food by puncturing the tissues of plants and then extracting the plant juices. All parts of plants are attacked, but tender young shoots and maturing fruit are greatly preferred. Among the garden, truck and soiling or cover crops injured, are tomato, Irish potato, sweet potato, beans, cowpeas, beggarweed, radish, collard, cabbage, turnip, mustard, okra, etc. In fall and early winter the insect sometimes becomes a serious pest in citrus groves, feeding especially upon the fruit, young seedlings and young shoots of older trees. Similar infestations have been reported for pecan groves.

Notes on habits and life history studies have been carried on at Gainesville, Florida. Hibernation is imperfect, about one-half of the individuals remaining upon succulent plants in the field throughout the winter months. No breeding takes place during the winter. Eggs have been found outdoors during the second week of April and as late as December 12. The eggs are deposited in clusters, mostly on the underside of the leaves. Some females deposited no eggs, while others laid one, two or even three egg clusters. One female laid 212 eggs, three clusters of 78, 70 and 64 eggs respectively. No eggs were found in her ovaries at death. 40 egg clusters, collected consecutively in the field, contained 3544 eggs, averaging a little over 88 eggs to a cluster. The clusters were made up of from 46 to 126 eggs.

The minimum period for incubation was 4 days. The minimum time for the five nymphal instars, based on individual records, was 24 days. This gives a total of only 28 days from the time the eggs are laid until the adult state is reached. Field records indicate that there are four generations annually at Gainesville and probably five in the southern portion of the state. Development was more rapid during the summer than either spring or fall, temperature having an important bearing upon the period of development of both eggs and nymphs. Table 1 gives the variation in time for the development of nymphs from two different egg clusters and shows that the first nymph to issue from an egg in a cluster is not always the first to reach the adult state.

Six predaceous enemies have been recorded in the field, the Florida predaceous bug *(Euthyrhynchus floridanus)* being the most important.

Three parasites of the adult and two egg parasites have been reared. Out of 800 adults of *Nazara viridula* collected in the fields during the latter part of May and the first of June, 38 per cent were killed by two dipterous parasites, 31 per cent by the tachinid fly, *Trichopoda pennipes,* and the rest by the sarcophagid fly, *Sarcophaga sternodontis.* Both of these parasites were also bred from a number of other plant-feeding insects in Florida. The egg parasites were not common at Gainesville and are represented by undescribed species.

In most cases parasitized specimens of *Nezara viridula* failed to deposit eggs before they died. In a few instances females, collected in the field, deposited eggs before they died from the effects of parasitism. Breeding experiments in the insectary show that, if the eggs are nearly or fully developed within the ovaries of *Nezara viridula* when the eggs of the tachinid fly (*Trichopoda pennipes*) are placed on her body, a female will sometimes deposit eggs after being parasitized. Of course, not more than this one egg cluster is laid before the insect is destroyed. Pairs have been collected while feeding and copulating in the field during the late afternoon and both sexes died from the effects of parasitism during the following night.

When valuable garden and truck crops are heavily infested, hand collecting seems to be the best control method. The proper management and cutting of the cover or soiling crop will usually keep the insects under control in citrus groves, also in pecan groves. In case of severe infestation in citrus groves it has been demonstrated (J. R. Watson) that hand collecting with large nets can be done successfully and profitably. In using large nets the work should be done in early morning or on cool days when the temperature is below 70° F. At a higher temperature many of the adult bugs will save themselves by taking flight before they drop into the nets.

Of both wild and cultivated vegetation the insects generally show a decided preference for leguminous and cruciferous plants. During late fall, winter (individuals that do not seek protected places to hibernate) and early spring the bugs often congregate upon cruciferous plants as radish, collard, Chinese cabbage, rape, mustard, turnip, etc. Some of these plants might serve as a valuable trap crop for late fall, winter and spring. Experiments at Gainesville, Florida, during the summer show that radish and collard, both growing in the same row, will serve as a trap crop to protect tomatoes. The seed should be planted about November 1st so that the radish will be forming pods while the fruit of tomato is developing and ripening during the following spring. The insects should be gathered by hand.

Leguminous plants, as cowpeas, rattle-box, beggarweed, beans, etc., are much preferred to other plants during the summer and early fall, especially during the pod-formation period. Rattle-box, *Crotalaria urasamoensis,* probably offers one of the greatest possibilities as a trap and propagating crop during the summer. The plant itself is probably not more or perhaps as attractive to the bugs as cowpeas and beggarweed, but the blossoms are very alluring to the parasites. The principal parasite, *Trichopoda pennipes,* is a honey-loving insect and was a constant visitor to the flowers of rattle-box. From 10 to 80 per cent of the specimens of *Nezara viridula* collected on rattle-box bore eggs of *Trichopoda pennipes.* On this account it seems that rattle-box should be grown as a propagating plant during summer and thus increase the number of parasites. The long blooming and pod-formation period adds much to the value of the plant as a trap and propagating plant.

LITERATURE CITED

For a complete bibliography of **Nezara viridula** Linn., see Distant (1880, p. 78), Lethierry and Severin (1893, pp. 167 and 268) and VanDuzee (1917, pp. 58 and 59).

ALDRICH, J. M.
1905—Catalogue of North American Diptera. Smithsonian Miscellaneous Collections, Vol. XLVI, pp. 1-680.
1916—Sarcophaga and Allies in North America. Thomas Say Foundation of the Entomological Society of America, pp. 1-301.

ATKINSON, E. T.
1889—Notes on Indian Insect Pests. Rhynchota. Indian Museum Notes, Vol. I, No. 1, pp. 1-8.

BARBER, HARRY G.
1914—Insects of Florida. II. Hemiptera. Bulletin of the American Museum of Natural History, Vol. XXXIII, Art. XXXI, pp. 495-535

BERGROTH, E.
1914—Notes on some Genera of Heteroptera. Annales de la Sociéte Entomologique de Belgique, Tome LVIII, pp. 23-28.

BUENO, J. R. DE LA TORRE.
1912—Nezara viridula Linne, an hemipteron new to the northeastern United States. Entomological News, Vol. XXIII, pp. 316-318.

CHITTENDEN, F. H.
1902—Some Insects Injurious to Vegetable Crops. Bulletin 33, New Series, United States Department of Agriculture, pp. 1-117.

DISTANT, W. L.
1880—Biologia Centrali-Americana. Heteroptera, Vol. I, pp. 1-462+XX, 39 plates.

FABRICIUS, JOHANN C.
1775—Systema Entomologia, etc. Hafniae. (Describes varieties **smargdula** and **torquata** on pages 710 and 711.)

FROGGATT, WALTER W.
1916—The tomato and Bean Bug. Agricultural Gazette of New South Wales, Vol. XXVII, part 9, pp. 649-650.

GIRAULT, A. ARSENE.
1907—Hosts of Insect Egg-Parasites in North and South America. Psyche, Vol. XIV, pp. 27-39.

HORVATH, G.
1903—Szerbia Hemiptera-Faunaja, Annales Historico-Naturales Musei Nationalis Hungarici, Vol. I, pp. 3-28 (Describes variety **hepatica**).

HUBBARD, H. G.
1885—Insects Affecting the Orange. United States Department of Agriculture, Division of Entomology, pp. 1-227.

JOHNSON, C. W.
Insects of Florida, Diptera. Bulletin of the American Museum of Natural History, Vol. XXII, Art. 3, pp. 39-90.

JOHNSON, CHAS. W.
1913—Insects of Florida, Bulletin, Amer. Mus. Nat. Hist., Vol. XXXII, Art. III, pp. 37-90.

JONES, THOMAS H.
1918—The Southern Green Plant-bug. United States Department of Agriculture, Bulletin, 689, pp. 1-27.

LETHIERRY, L., and SEVERIN, C.

1893—Catalogue General des Hemipteres. Tome I. Heteropteres. Bruxelles.

LINNAEUS, CARL.

1758—Systema Naturae per Regna Tria Naturae, etc. Ed. 10. Holmiae.

MORRILL, A. W.

1910—Plant-bugs Injurious to Cotton Bolls. U. S. Department of Agriculture, Bulletin No. 86, pp. 1-110.

NOWELL, WILLIAM.

1917—Internal Diseases of Cotton Bolls in the West Indies. West Indian Bulletin, Vol. XVI, pp. 203-235.

RILEY, CHARLES V., and HOWARD, LELAND O.

1889—Special Notes. Insect Life, Vol. II, p. 61.

1893—Extracts from correspondence. The sweet-potato Root-weevil. Insect Life, Vol. V, p. 261.

1893—Extracts from correspondence. Plant-bugs injuring oranges in Florida. Insect Life, Vol. V, pp. 264 and 265.

ROSENFELD, J. H.

1911—Insects and Spider in Spanish Moss. Journal of Economic Entomology, Vol. IV, pp. 398-409.

SHARP, DAVID.

1890—On the terminal segment of some male Hemiptera. Transactions of Zoological Society of London, pp. 399-427.

TURNER, WILLIAM F.

1918—Nezara Viridula and Kernal Spot of Pecan. Science, Vol. XLVII, pp. 490 and 491.

VAN DUZEE, EDWARD P.

1904—Annotated List of Pentatomidae from America North of Mexico, with descriptions of some new species. Transactions of the American Entomological Society, Vol. XXX, pp. 1-80.

1907—Observations on Some Hemiptera taken in Florida in 1909. Bulletin Buffalo Society of Natural History, Vol. IX, pp. 149-230.

1917—Catalogue of the Hemiptera of America North of Mexico. University of California Publication. Technical Bulletin, Vol. II, pp. 1-902.

WATSON, JOSEPH R.

1916—Pumpkin Bugs in Citrus Grove. The Florida Grower, November 18, 1916, pp.3-4.

1917a—Florida Truck and Garden Insects. University of Florida Agricultural Experiment Station, Bulletin 134, pp. 33-127.

1917b—Pumpkin Bugs in Citrus Groves. University of Florida Agri-Cultural Experiment Station, Press Bulletin 283.

1918a—Annual Report for 1917. University of Florida Agricultural Experiment Station, pp. 52R-65R.

1918b—Insects of a Citrus Grove. University of Florida Agricultural Experiment Station, Bulletin 148, pp. 165-267.

1918c—An Outbreak of the Cotton Stainer on Citrus. Florida Buggist, Vol. II, No. 2, pp. 88-89.

WEED, C. M., and CONRADI, A. F.

1902—The Squash Bug. New Hampshire College Agricultural Experiment Station, Bulletin 89, pp. 15-28.

WHITMARSH, R. D.

1917—The Green Soldier Bug. Ohio Agricultural Experiment Station, Bulletin 310, pp. 517, 552.

A BLOSSOM DESTROYING BEETLE ON THE MANGO

G. F. Moznette*

When the mango is in bloom it may be visited in swarms by a beetle which when present in considerable numbers may cause serious damage and great concern to the grower. Fortunately up to this time the writer has not observed this beetle to be generally distributed at blossoming time, and may be found in groves in certain localities where others escape. The following year the groves visited the previous year may escape, when others may in turn be visited by this blossom devouring pest. Up to this time this species has attracted attention of growers in the section of Dade County south of Miami, Florida.

This destructive insect was first brought to the writer's attention in February, 1918, when a grower at Larkins, Florida, advised the writer as to destructive work caused by some pest to his mango bloom. Upon examination the writer found the bloom severely eaten, the culprit attacking all portions of the blossom spike, and in many instances completely girdling the same or cutting it off as with a knife, (Plate 1). Usually, however, the beetles confined their attacks to the more tender floral parts destroying the individual floral clusters about the spikes. The beetles were often seen to congregate at the base of the spikes where they gnawed away the outer tissues of the floral spikes, and at other times the beetles gathered at the tops of the spikes destroying everything that came in their path.

During the day numerous freshly eaten floral spikes could be found but the presence of the destructive pest causing the damage could not be detected about the bloom or anywhere on the trees. It was observed, however, that below the trees numerous small entrance and emergence holes were present in the soil. Upon uncovering the soil to a depth of from one inch to two inches a considerable number of small beetles were to be found in a quiescent stage as if playing possum. After a few minutes, however, on exposure to the light the beetles became active and immediately started to dig their way into the soil.

This grove was visited during the evening about eight o'clock of the same day. When among the trees a very familiar sound could be heard as if one were manipulating a hive of bees during the day. On bringing a light gradually up to the bloom great

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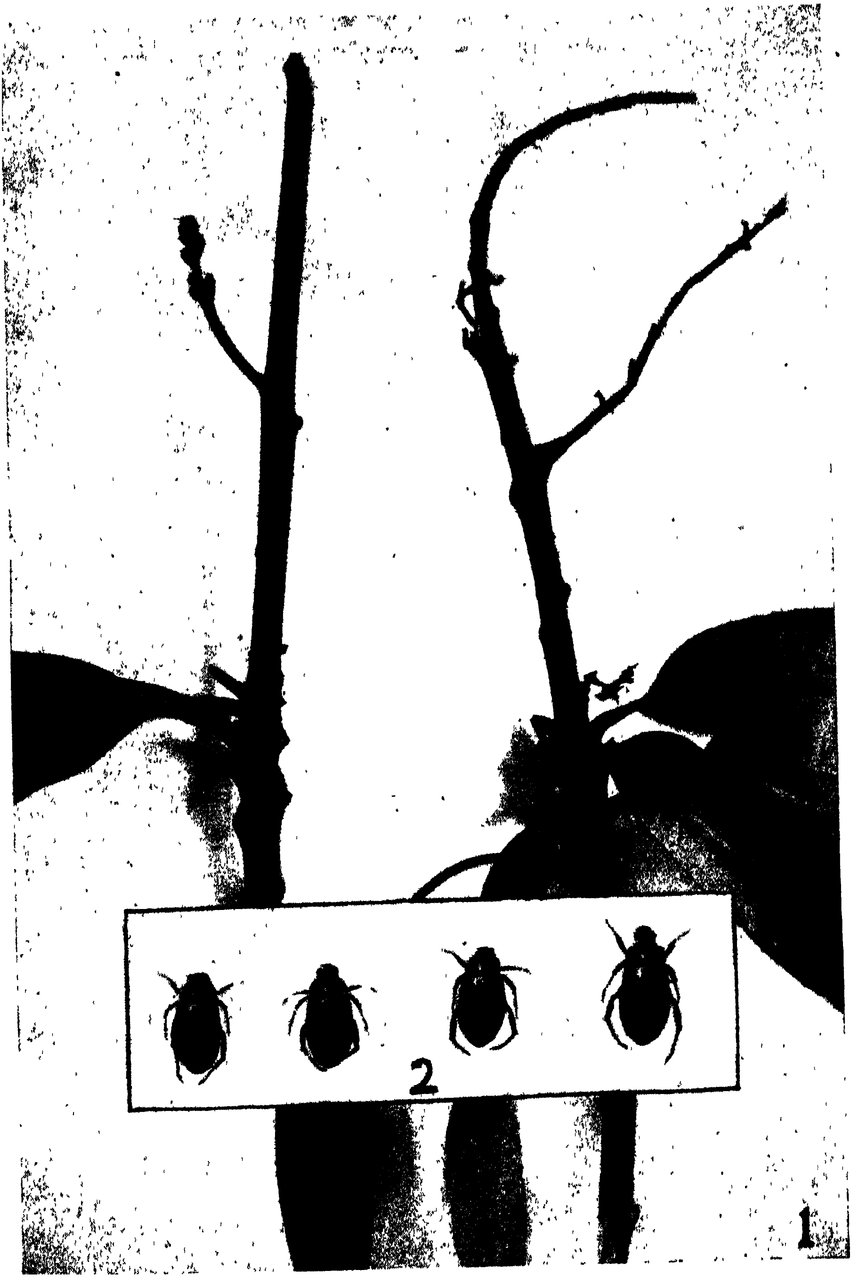

Plate 1.—A blossom destroying beetle of the mango: 1, injury by the beetle to mango blossom spikes; 2, the beetle, *Anomala undulata* Mels.

numbers of the same beetles found during the day in the soil below the trees were busy at work feeding and flying about the blossom spikes. On bringing the light closer the beetles were seen to drop in great numbers making a noise like rain as they fell upon the dried mango leaves below the tree. To illustrate their abundance at the time these beetles were observed feeding on the mango at Larkins, Florida, it was decided to stretch a large strip of tarpaulin below a tree to see how many adult beetles could be gathered from a single jarring of the tree. The writer gathered as many as could be captured approximately thirteen hundred adult beetles.

The adult beetle (Plate 1, "2") known scientifically as *Anomala undulata* Mels. has a black thorax with a yellowish border; the wing-covers yellowish, with two cross-rows of ill-defined black spots, sometimes almost wanting. They vary in size from a quarter inch to five-sixteenths of an inch in length. However, various variations of the color may occur and the writer has found on a number of occasions nearly black forms. The species is closely related to the so-called May-beetles. Up to this time the writer has been unable to find either the larval form or the host plant upon which it feeds. Judging, however, from similar species the larval form must be closely similar except for their smaller size, to the white-grubs, or May-beetle larvae, not only in general appearance, but more or less in habits also. The larvae probably will be found feeding on the roots of some native or cultivated plant either growing on the pine lands or in the stretches of everglades. In the middle west where this species is also found nothing has been recorded as to the larval habits of this pest.

The writer has also noticed this species feeding on avocado bloom depending, of course, on the time of blossoming and the time the swarms of the beetle occur. The species was also noticed feeding extensively in a bean patch at Redlands, Florida, the beans being practically defoliated. In the middle west it has been recorded as infesting a variety of crops, often to their serious injury. The beetle has been reported from Ohio where it has been found stripping the leaves from plum and pear trees, and also from cherry trees in Illinois. They have been reported as frequently injurious to wheat and other grains in Kansas feeding on the heads when the grain was "in the dough."

CONTROL

The best means of control has been found to be spraying the blossom spikes with a poison. At the time the mango is being sprayed in the bloom for the Colletotrichum blight which attacks the blossom a combination spray may be used to good advantage. By spraying with two pounds of either powdered arsenite of zinc or arsenate of lead to fifty gallons of the diluted Bordeaux mixture the grower will find that the beetles will be readily killed or the spray will serve as a preventive measure causing the beetles to seek new feeding grounds. The Bordeaux mixture is generally used at a strength of 3-4-50 with the addition of two pounds of soap preferably the resin-fish-oil soap. The soap will cause the spray to spread much better than if it were not incorporated in the combination spray. After the Bordeaux mixture is made and in the tank the resin-fish-oil soap is added after which the particular poison used against the beetles is placed in the tank. It is essential where the powdered arsenate of lead or arsenite of zinc are used, that the spraying outfit be fitted with a good agitator as the poison has a tendency to settle rapidly to the bottom of the spray tank. The spray should be directed at the blossom parts particularly as the beetle does not attack the dormant foliage, and very little if any new growth is present on the mango at the time of blossoming.

PAPAYA LEAF BLIGHT*

H. E. STEVENS

A leaf blight of the papaya (*Carica papaya* Linn.) has recently been reported to the State Plant Board from St. Cloud, Fla. It was learned from the owner of the infected plants that the disease first appeared this year on his place and spread very rapidly The affected leaves of plants attacked soon begin to dry up at the edges and appear as if they had been near a fire. The disease was also observed on some of his neighbors' plants. He further stated that there had not been a papaya plant on his place for the past three years that he had not grown himself, so the disease was evidently brought onto his premises by means of some agent as a carrier. It probably came from one of his neighbors. It is not evident at the present time just how and when the disease was brought to St. Cloud.

***Pucciniopsis caricae* Earle.

This is not a new disease as it has been previously reported from Porto Rico, Cuba, British Guiana and Sanibel Island. Fla. This appears, however, to be the first report of its presence on the mainland of Florida, and it might prove to be a serious pest to papaya plants in the southern part of the State should the disease become widely distributed.

While papaya growing is of minor importance at the present time, still there are many persons who grow them for family consumption, and those who are interested in the production of papayas should guard as far as possible against the introduction of this disease into any of their plantings.

Leaf Blight or Leaf Spot is a fungus disease caused by *Pucciniopsis caricae.* Specimens of this disease were first collected by S. W. Tracy (1) on Sanibel Island in 1901. It was again reported from Porto Rico in 1903 by Earle (2) and later by Stevenson (3) who states at times it is a serious pest causing practical defoliation of the plants affected. We also have a specimen of the disease in the Experiment Station Herbarium collected in Cuba by C. F. Baker in 1906. Brancroft (4) includes *Pucciniopsis caricae* in a list of fungi reported from British Guiana in 1918. While the fungus has been known for some time and frequently observed in different countries it has been considered more or less of minor importance. However, we do not know just how it might behave under our Florida conditions and it would not be wise to experiment with it along these lines.

APPEARANCE OF THE DISEASE

The disease is striking, and easily recognized by the black pustular spots on the under surfaces of infected leaves, suggestive of Sooty Mold. On the upper surfaces of the leaves the infected areas appear as brown circular spots distinctly outlined. The spots are usually small varying from 1/8 of an inch to mere dots. From a few to several hundred spots may be present on a single infected leaf.

Infections on the under surface of the leaf are represented by black, round masses, called sporodochia, which are raised slightly above the leaf tissue. The small, brown, septate spores of the fungus are found abundantly in these black masses and it is by means of these spores that the disease is spread. They may be blown by the wind or carried by insects over a considerable area.

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(1) Earle, S. F. Bul. N. Y. Botanical Garden, Vol. 2, No. 7, p. 340.
(2) Earle, S. F. Ann. Rept. Porto Rico Expt. Sta. 1903, p. 467.
(3) Stevenson, John A. Ann. Rept. Porto Rico Ins. Sta. 1916-1917, p. 9
(4) Brancroft, C. K. Jour. Board Agric. British Guiana 11:47-57, 1918.

Severe attacks of the disease will cause defoliation of the plants resulting in death or a very much weakened plant.

CONTROL

Very little attention seems to have been given this disease especially in regard to control measures, and such recommendations as can be suggested at the present time are only tentative.

If the disease is discovered in time it can probably be easily controlled by the use of Bordeaux Mixture. Three or four sprayings at intervals of ten days to two weeks apart with 3-3-50 Bordeaux Mixture should put down a mild attack. In this case the object should be to keep the slightly infected leaves covered with the Bordeaux to kill any spores produced, and the new leaves well protected during that period to prevent new infections. Both under and upper sides of the leaves should be thoroughly covered with the Bordeaux Mixture. In cases of severe attacks all of the older infected leaves should be removed and destroyed. The remaining foliage should be thoroughly sprayed with 3-3-50 Bordeaux at weekly intervals, until the new leaves that develop are entirely free from infection. If the badly infected plant is a young one it will be more economical to destroy it and start with a healthy plant.

Seedling plants should be closely watched especially if they are grown in the vicinity of old plants carrying the disease. In such cases frequent applications of Bordeaux Mixture will be necessary to protect the seedlings from the disease.

When the Leaf Blight appears efforts should be made to eradicate it as soon as possible.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*..........*Editor*

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Entered as second-class matter November 14, 1916, at the postoffice at Gainesville, Florida, under the Act of June 6, 1900. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized July 10, 1918.

DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING MARCH 31, 1920.

Citrus grove trees inspected	1,909,863
Citrus nursery trees inspected	7,868,270
Inspectors employed	104
New properties showing infection	0
Total properties showing active infection	0
Grove trees found infected	0
Nursery trees found infected	0
Counties in which active infections were found	0

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,727
Nursery trees found infected since May, 1914	342,254
Number properties infected to March 31, 1920	481
Properties declared no longer "danger centers"	479
Properties still classed as "infected" March 31, 1920	2

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to March 31, 1920:

1914		1915		1916		1917		1918		1919		1920	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1	Mar.	0
		Apr.	408	Apr.	49	Apr.	169	Apr.	2	Apr.	1		
May	108	May	1042	May	338	May	52	May	1	May	1		
June	160	June	772	June	450	June	45	June	10	June	0		
July	275	July	651	July	349	July	39	July	0	July	0		
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0	Aug.	1		
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0	Sept.	0		
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0	Oct.	0		
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0	Nov.	0		
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0	Dec.	0		

QUARANTINE DEPARTMENT

REPORT ON INSPECTIONS AND INTERCEPTIONS, ALL PORTS AND STATIONS, FOR THE QUARTER ENDING MARCH 31, 1920.

The Black Fly, *Aleurocanthus woglumi,* Ashby, continues its efforts to gain entrance to Florida. During the quarter just ended it has been intercepted three times on material from Cuba. In two instances it was on citrus and one instance on mango. In connection with the parcel post inspection it was also intercepted, in a mail package from Cuba, on one occasion.

The destructive scale-insect, *Aspidiotus destructor,* Signoret, also continues its efforts to invade Florida. During this quarter it has been intercepted in shipments from Cuba, Porto Rico and the Isle of Pines. In all it has been "stopped" 29 times during the three-month period.

The rind disease of sugar cane has been prevented entry to the State on two occasions; once from Cuba and once from the Isle of Pines.

Another "caller" at our ports was a scale-insect, *Targionia hartii* Ckll. on yam from Georgetown, G. C.

A striking development in connection with the inspection of nursery stock shipments from other states to Florida was the relatively large number of shipments infested with San Jose scale, this pest having been found in 36 shipments during the quarter. Most of these shipments came from the Southeastern States, with some from points as far west as Louisiana and some as far north as North Carolina.

During the quarter no less than 408 packages and shipments containing injurious insect pests or plant diseases have been prevented delivery to Florida citizens. These shipments contained enough pests, if established, to cause ultimate losses amounting to many thousands of dollars. In fact, it would be impossible to estimate the value of the protection afforded Florida agriculturists by the quarantine service.

A condensed summary of the quarantine inspection work for the quarter follows:

REPORT ON INSPECTION AND ERADICATION WORK FOR THE QUARTER ENDING MARCH 31, 1920

GENERAL SUMMARY

SHIPS INSPECTED:			
From Foreign Ports	745		
From U. S. Ports other than Florida	324		
From Florida Ports	212		
Total		1281	
NUMBER OF PARCELS INSPECTED:			
Arriving by Water:			
Passed	143,452		
Treated and passed	4215½		
Returned to shipper	336		
Contraband destroyed	717½		
Total		148,721	
Arriving by land, express, freight, wagon, etc.:			
Passed	2376		
Treated and passed	63½		
Returned to shipper	56½		
Contraband destroyed	72		
Total		2568	
Arriving by mail:			
Passed	314½		
Treated and passed	20		
Returned to shipper	53		
Contraband destroyed	7½		
Total		395	
GRAND TOTAL OF PARCELS INSPECTED			151,684
Number of parcels on hand pending determination as to final disposition	2687		
TOTAL PARCELS PASSED		146,142½	
TOTAL PARCELS TREATED AND PASSED		4299	
TOTAL PARCELS RETURNED TO SHIPPER		445½	
CONTRABAND DESTROYED		797	
GRAND TOTAL			151,684

BEE DISEASE ERADICATION

REPORT ON INSPECTION AND ERADICATION WORK FOR THE QUARTER ENDING MARCH 31, 1920

Number of apiaries inspected	44
Number of apiaries infected with American foul brood	7
Number of colonies inspected	1,246
Number of colonies infected with American foul brood	24
Number of colonies destroyed American foul brood	24
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	0
Number of colonies treated, European foul brood	0
Number of colonies infected with sacbrood	5

GENERAL SUMMARY

Number of apiaries inspected since July 1, 1919	195
Number of apiaries infected with American foul brood	23
Number of colonies inspected since July 1, 1919	8,951
Number of colonies infected with American foul brood	78
Number of colonies destroyed, American foul brood	78
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	3
Number of colonies treated, European foul brood	3
Number of colonies infected with sacbrood	8

WHITEFLY FUNGUS

E. W. BERGER

The Entomological Department of the State Plant Board now has ready for distribution approximately 3,000 pure cultures of the Red Aschersonia and Yellow Aschersonia. A culture consists of the amount of fungus that can be grown in a wide-mouth pint bottle, and is sufficient for starting the fungus in an acre of grove.

The two fungi named are diseases, or parasites, of the common whitefly and the cloudy-winged whitefly, both of citrus. Under favorable weather conditions, plenty of moisture and warmth, these fungi produce such a satisfactory control of these whiteflies that other treatment often becomes unnecessary. Many experienced growers, therefore, like to introduce the fungi into their whitefly-infested groves during the period of summer rains, which is the ideal time to introduce them.

When ordering, growers are requested to send a few dozen leaves for examination in order that we may determine whether to include in the order one or more cultures of the Yellow Aschersonia, regarded by some as more effective against the cloudy-winged whitefly.

The price is 75 cents per culture, approximately the cost of production. TRANSPORTATION CHARGES ARE PAID BY THE PURCHASER.

Remittances should be made payable to "State Plant Board of Florida" (postage stamps cannot be accepted). Address: Entomological Dept., State Plant Board, Gainesville, Florida.

Orders for fungus should be accompanied by remittance, as otherwise same will be sent C. O. D.

Name nearest express office when this is not the same as the postoffice address.

Orders for fungus of one to three cultures will be sent by parcel post only when necessary postage money is included with remittance. Shipping weights: 1 culture, 2 pounds; 2 cultures, 4 pounds; 3 cultures, 5 pounds.

THE QUARTERLY BULLETIN

State Plant Board of Florida

Vol. IV JULY, 1920 No. 4

IMPROVE THE FLORIDA CITRUS VARIETIES

LEO B. SCOTT

I have had the pleasure of attending a number of meetings of Florida citrus growers. On all of these occasions I have talked on one general theme—the need of eliminating some of your worthless sorts of oranges and grapefruit, and the development of the best producing strains within your standard varieties. I am going to continue to talk along these same lines—others will do the same thing—and we are not going to stop talking either until every citrus tree in Florida is bearing a good crop every year of fine quality fruit.

The first meeting of citrus growers which I attended in Florida was the memorable session of the Citrus Seminar, held at Gainesville in October, 1915. Although I was not then familiar with Florida conditions, it did not take me long to realize that your big problem which you had to face was the eradication of citrus canker. How well you have succeeded is shown in the monthly reports issued by your Plant Commissioner. The work of the State Plant Board and the Bureau of Plant Industry has meant millions to Florida, in fact, the saving of the citrus industry, and I am thankful in saying that all the citrus growers of this state realize it.

During 1915-16 we attended several meetings of fruit growers in different parts of the state, and discussed, both formally and informally, the subject of Florida's citrus varieties. At the Seminar at Gainesville in 1916 a committee of representative citrus growers and nurserymen was selected, who agreed that in their judgment the following short list of orange varieties should be developed as the standard oranges for Florida. These in order of maturing, were Parson (Parson Brown), Homosassa, Pineapple, Valencia and Lue (Lue Gim Gong). The committee's report was accepted by the growers assembled there. No action was taken on the question of grapefruit varieties.

In 1916-17 my associate, Mr. E. D. Vosbury, was stationed in Florida in charge of the subtropical fruit production investigations of the United States Department of Agriculture in this state. A portion of his duties consisted in securing data on grapefruit varieties, and assisting growers in inaugurating systems of securing individual-tree performance records in their groves. The freeze of February, 1917, interfered with our work. In many orchards the fruit was injured to some extent, and growers, feeling the records would be of little value that year, discontinued them.

Next came the great war and during this period the labor situation was acute. If the ordinary routine duties, such as cultivation or fertilization of the grove, or even the picking of the fruit, were properly attended to the grower was satisfied. It was not a time to suggest changes. Although we attended some meetings in Florida during this period, as far as our subtropical fruit investigations in this state were concerned we simply "marked time".

With the ending of the war conditions have changed. The labor situation will not be the same next year as last. The demand for citrus fruits is bound to increase from year to year. Oranges, grapefruit, lemons and limes are looked upon in many places as actual necessities. In many homes in the North citrus fruits appear on the menu every day in the year. As more people become accustomed to using citrus fruits the popular taste will become more discriminating. The northern buyer will purchase the clean, bright fruit which has some distinctive characteristic by which he can readily identify the variety, in preference to dirty, sooty fruits which have no distinctive characteristics, and which are packed in boxes containing both seedling fruits and those of budded varieties.

How will the progressive grower meet this situation, which I believe marks a new era in the development of the citrus industry in this state? By better grove sanitation? True, improved methods of cultivation, fertilization and pruning should be used. Better spraying or fumigation should be practiced. By greater care in handling? Yes, even more care should be used in picking and packing the fruit than in the past. By better advertising? Again the answer is in the affirmative. All of these factors are vitally important to the development of the industry. It seems to me that there is one other factor on which all the others rest, and which we are prone often to overlook, and this is a standard uniform product.

The success of the California citrus industry has been due to three things: (1) Cooperation among the growers, (2) extensive and comprehensive advertising of their product, and (3) the presence of only a few varieties which the purchaser quickly learned to know.

California has two orange varieties, the winter orange, the Washington Navel, and the summer fruit, the Valencia. The purchaser soon learned to know these varieties. Although the fruits are always sold in boxes labeled Washington Navel or Valencia, the purchaser knew the Washington Navel fruits by their outer trademark, the navel character, and he knew the other orange must be a Valencia because it was *not* a navel.

Florida oranges are marketed simply as Florida oranges. That statement may be too sweeping, for occasional boxes are seen marked Pineapple or Valencia. More often, however, Pineappels will be packed in the same box with seedlings, and the innocent purchaser has absolutely no guarantee of what he is getting.

The action of the committee at Gainesville is a start. It gives growers and nurserymen a basis on which to work, but it is only a beginning. Do not misunderstand me. The action of the committee does not mean that the list can not be revised from time to time. However, no new varieties should be added to the list, or substituted for any of the standard ones, unless (1) they are annual producers of heavy crops, (2) the fruit must have some distinctive or superior characteristic in time of ripening or in flavor, and (3) the fruit should have some external charactertistic by which it can be easily identified by the purchaser.

I believe a registry committee, not only for citrus fruits, but for all other fruits, should be an important committee of your State Horticultural Society. I would like to call your attention to the action of the California Avocado Association. Three years ago the avocado varietal situation in that state was somewhat comparable to your problem with citrus fruits. About 140 varieties of avocados had been introduced, named, and described, and were being sold by the nurserymen. We began an investigation of the varietal situation and reported to the directors of the association from time to time. Others in the state conducted similar investigations.

After the investigations had been conducted for about a year a report was made to the registration committee of the association, who carefully discussed the merits of every variety, and finally agreed on a list of eight which they recommended for planting in California. Think what a reduction in one year's time,* from 140 to 8! However, they specified that if a new variety should be developed which has characteristics far superior to some of the existing ones, and if, in their opinion, its performance justified, it could be added to the list or substituted for some of those which were previously recommended.

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*May 15, 1920. The variety list has been further reduced.

Such a plan could be followed with your citrus varieties. However, even when you reduce the number of your varieties, and even when you market your fruit as varieties and not simply as oranges and grapefruit, your problem is only partially solved. Not all the trees within the variety bear the same type of fruit. In the same grove we find marked differences among individual trees. You have got to go farther than the variety; you will have to develop the best strain within each variety. By that word "strain" I mean a collection of individuals within a horticultural variety, which, while retaining the general characteristics of the variety, have such clear-cut characteristics of their own that they can be easily distinguished from other groups of individuals within the variety. How have these strains originated? By bud variation. In the Washington Navel orange alone we have found thirteen strains; in the Valencia twelve, and in the Marsh grapefruit five. Corresponding variations have been found in other varieties. The strains are found occurring as whole trees, as limb sports, and as individual fruit sports; some are worthy of propagation, many are not. For a full description of these strains I would refer you to United States Department of Agriculture Bulletin No. 623, "Citrus-Fruit Improvement: A Study of Bud Variation in the Washington Navel Orange"; No. 624, "A Study of Bud Variation in the Valencia Orange"; and No. 697, "A Study of Bud Variation in the Marsh Grapefruit".*

Although some of the detailed studies of variations in citrus varieties have been conducted in California, nevertheless you have similar variations within your varieties. Even within the standard strain you will find differences in production of individual trees, which in many cases are so pronounced as to mean an actual loss on the whole grove to the owner. One tree bears eight boxes of fruit, the one next to it one. These differences are found to be consistent from year to year. No matter how much care and attention you give the one-box tree you cannot bring it up to the level of the eight. The one is inherently a heavy producer, the other is not. You will also find the eight-box tree bears fine quality fruit, the other anything but fancy fruit.

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*May 15, 1920. Two other bulletins in this list soon will be available, "Citrus-Fruit Improvement: A Study of Bud Variation in the Eureka Lemon", and "Citrus-Fruit Improvement: A Study of Bud Variation in the Lisbon Lemon".

In all our work with citrus varieties we have generally found quantity is correlated with quality. The high producer as a rule also has the best quality fruit.

In one lemon orchard in California which came under my observation ninety-five per cent of the trees were *shade* trees, one of the unproductive strains of the Eureka lemon. Fine, healthy, vigorous growing trees, but as the name of the strain indicates, more suited for an ornamental shade tree than for an orchard. I am glad to say, however, that this orchard has since been top-worked to the ideal productive strain of the Eureka lemon.

How are you going to find these slacker trees, these drones in your orchard? The only efficient way is by securing individual-tree performance records.

By the term "performance record" is meant an actual record of the amount and quality of fruit borne by each individual tree in the orchard for a series of years.

As a result of the investigations which the Department of Agriculture has been carrying on for a number of years in the improvement of citrus fruits commercial individual-tree performance records are now being secured on thousands of acres of citrus trees in California and in a number of groves in Florida and Alabama.

For a complete description of a practical and established method of securing individual-tree performance records I would refer you to the United States Department of Agriculture Farmers' Bulletin No. 794, "Citrus-Fruit Improvement: How to Secure and Use Tree Performance Records".

Three important factors are involved in the securing of accurate individual-tree performance records. These are, first, a definite system of individual tree numbering; second, a definite system of individual tree picking; and third, the recording of the individual tree records in permanent record forms.

In order to effectively secure commercial individual-tree performance records it is absolutely necessary that the system of tree numbering which is used be a very simple and permanent one. A plan which has proved very practical under California conditions is to divide the orchard into a number of blocks. Each individual tree is given its own tree number and this number is painted on the tree trunk with white lead paint. This tree number consists of the block number, row number and the number of the tree in the row, thus: Tree 4-8-16.

4
8
16

instantly locates that tree as being in block 4, row 8, and the 16th tree from the end of the row, always numbering from some given point. Where such a system of tree numbering has been practiced it has been found that in a very short time unskilled laborers can be trained to perform this operation with the result that the cost incidental to the numbering of citrus trees varies from 40 to 50 cents per acre.

The advantages of such a system of tree numbering are at once apparent. No matter how large an acreage, there never will be a duplicate tree number.

In addition to the value which the individual-tree number will have in the securing of performance records, it also serves as a means of identification for the individual tree in a number of other ways. For instance, if a tree is found badly affected with scale the tree number can be jotted down in a notebook and that tree can be given instant attention. Tree numbering probably is one of the most essential points in the systematizing of grove and orchard operations.

If, because of weather conditions or the peculiar branching habit of trees, as is common in many old Florida groves, it may not be advisable to paint the tree number on the tree trunk, in this case the tree number could be stamped on an aluminum label, the label attached to a long copper wire, the wire attached to a copper nail and this nail driven into one of the main branches or tree trunk. Some modification of these two methods of tree numbering will be applicable to citrus conditions in any grove.

A second important factor in the securing of individual-tree records is that each tree be picked separately. In large citrus groves it will be necessary to have one man for each row. He should be assigned to the first tree in that row, pick all the fruit from that tree and assemble it in boxes at the base of the tree before proceeding to the second one. In large picking crews it will prove expedient in order to conserve the picker's time, to have one man whose sole duty is placing of the empty boxes under the individual trees. After the performance records are secured, this man will carry the full boxes to the wagon and help load the wagon.

TABLE 2—ANNUAL CITRUS TREE RECORDS

Year.................................... Variety....................................

Block No.................................. Grove....................................

Row No.................................... Location....................................

PICKING DATES

	FIRST PICK			SECOND PICK				
Tree No.	Boxes	Part Boxes	Grade	Boxes	Part Boxes	Grade	Total	Notes
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								

In large picking crews one man will have to be detailed whose sole activity will be the recording of individual performance record data. In smaller crews the picking foreman probably can secure this information himself. This man should be provided with suitable field note books for securing these records. Before recording the amount of fruit borne by any tree he should see that the boxes are properly filled and should not record a full box unless the box is filled with fruit level with the top.

Table 2 shows an actual citrus tree record which can be used in securing records of individual orange and grapefruit trees' production. Space is provided in the heading of the blank for recording the year, block number, row number, variety, name of grove and location of grove.

As in many sections at least two picks are made of oranges and grapefruit each year a place is left on the blank for recording the amount and quality of fruit obtained at each pick. Space is provided for the recording of the data from 40 trees on each page. Probably never more than 40 trees will be found in any given row. In the first column the number of full boxes borne by the tree is recorded. In the second column is a place for recording the fractional box remaining, if there is any, from each tree. For all practical purposes this can be expressed either as 1-4, 1-3, 1-2, or a similar fractional term. While it will not be practical to grade the fruit closely in the field, it will be possible by a very hasty examination to determine, in a general way, the quality of fruit borne by each tree. In the column marked "grade" the quality of each individual tree can be designated by the letters A, B, C or D. If the tree produces a noticeable numble of sports, freaks, or off-type fruits, this fact can be noted in the column headed "notes".

If care is used in the field in recording the individual-tree records there will be no need of transferring these records to any other form. At the end of the picking season, the individual tree records can be detached from the book and placed in suitable filing cases so that the records of each tree can be filed in one place.

The chief objection raised by growers who are not securing individual-tree performance records is the excessive cost which would result in the introduction of such an operation in their groves. On the contrary, it has been found where systems of securing commercial individual-tree records have been introduced in citrus groves that these records can be secured at practically little or no expense. As previously indicated, in discussing picking operations, it is necessary to reorganize in many cases the established plan of operations. In California citrus groves, for instance, the old method of picking fruit was to have a box row. In this box row the empty boxes were placed and here the wagons were loaded after the boxes had been filled. Four rows were picked each side of the box row. It was necessary after a picker had filled his sack with fruit to walk from the tree over to the box row and empty that sack of fruit. Under the new system of picking a box row is still used. One man, as previously indicated, scatters the empty boxes under the tree, the picker assembles his fruit in boxes under each individual tree. A second man or "secretary" secures the performance records of each individual tree's production and he, with the first man, carries the boxes over to the box row and loads the wagons. The pickers, however, as soon as they finish one tree, go right to the next one in that row, and it has been found in large picking crews that they actually pick enough more fruit in a day when using this new system to more than pay for the two extra men's time; so the actual securing of the records is accomplished with practically little or no additional expense. The heaviest item of expense in securing tree records is the initial one of numbering the trees.

At least two years' records, preferably longer, should be secured before a tree is actually condemned as being a nonproducer. At least four years' records should be secured before any budwood should be cut from the tree for use in nursery propagation, or in topworking unproductive trees.

After a grower has secured individual tree records for a series of years you will then ask,—What is the next step after a large number of unproductive trees have been located? If the trees are in an unhealthy condition, and their lack of production may be attributed to this fact, the only practical thing to do is to remove the diseased trees and replant with younger stock which you know has been propagated from fruit bearing wood taken from ideal trees of a standard strain of an established horticultural variety. If the old trees are in a healthy, vigorous condition, and to all outward appearances should be bearing profitable crops, and you find this condition holds true for several years, you are then practically safe in assuming that they are inherently unproductive, or slackers. The trees have already established a good root system and it would seem almost criminal to remove such trees if there is any other practical way to utilize them. We have found in our California investigations that unless the trees are very old and the bark does not work easily that it is much better to topwork or rebud the unproductive trees, using budwood from selected productive trees of standard varieties, than to remove the unproductive ones and replace with new stock. Three or four of the main branches can be used for topworking, the buds inserted in much the same way as you would follow in nursery propagation. If the wood is too old to work easily the trees can be cut back and sprouts allowed to grow, and the next season the buds can be placed in these sprouts. We have found with oranges, grapefruit and lemons in California that trees thus topworked began to bear some fruit the second year after working, to bear quite heavy crops the third year, and might be said to be in commercial production the fourth or fifth season.

In rebudding or in nursery propagation we only recommend the use of fruit bearing wood with the fruits attached. Our reason for saying this is, when you have secured your individual-tree records for a series of years, and have found that certain trees in the orchard bear consistently heavy crops of fine quality fruit, you will also find on examining some of these trees that there are occasional small limbs which bear fruit which is not typical of the variety. It is undoubtedly by using budwood from limbs such as these that many of the inferior strains within our standard varieties have originated in the past. In order to safeguard the possibility of propagating a worthless or undesirable strain we believe that the grower or nurseryman can well afford to sacrifice the fruits which are at the end of the bud sticks. By taking the fruits themselves as an actual guide he has then an additional guarantee for believing that the buds on that stick will produce the same type of fruit.

The first instance of extensive topworking with citrus trees which came to my attention was on the Chase Plantation at Corona, Cal., in 1911. Although no individual-tree performance records had been secured in that orchard at that time a careful survey of the orchard was made and three thousand unproductive or shade tree Eureka lemons were located. At the same time a careful tree census was made of all the other lemon trees in the orchard, and a number were picked out which appeared to be standard Eurka, and which bore very heavy crops, in contrast to the light producing character of the shade trees. Buds were taken from these superior producing trees, placed in the branches of the shade trees, and inside of two years every one of those trees thus topworked was bearing a considerable amount of fine quality fruit, and in the third year were all bearing good commercial crops. There was not a single failure. Since then thousands of trees have been topworked with selected buds in California orchards. As far as I know we have yet to hear of a single case where there has been a failure and buds have not come true to the strain desired.

Although many California growers are securing individual-tree records in their own groves, there has been such a heavy demand from other growers, and from nurserymen as well, for selected performance record buds that it was practically impossible to comply with the demand. The California Fruit Growers Exchange, which is a cooperative, non-profit, marketing organization, including between seventy and eighty per cent of the citrus growers in that state, recognizing the great value to the industry of having every tree within a variety producing practically the same type of fruit, organized in the Supply Company of the Exchange a department which is known as the Performance Record Bud Supply Department. This department furnishes to growers and nurserymen, whether they are members of the Exchange or not, buds from performance record trees of any of the standard citrus varieties grown there. Buds are only cut from trees where records have been secured for at least five or six years. In addition, the department, looking to the future, is starting individual-tree records in a number of groves so that in a few years they will be able to furnish practically all the buds which are used in the state. Buds are furnished to nurserymen and growers at a cost of five cents a bud to Exchange members, and six cents a bud to non-members. In the report of the manager of the Supply Company for the year ending September 1, 1918, it was shown that in this period of unusual depression, when there were practically no new plantings, and all the budwood sold could be directly charged to topworking, between two hundred and three hundred thousand buds were furnished by the Supply Company to citrus growers in California. The Bud Supply Department not only was operated at cost during the first year of its existence, but actually returned quite a little profit to the organization.*

I believe you should have some similar organization in Florida. I have urged this in the past. Some growers have thought the time was not yet ripe for such a public service in Florida. If, however, the growers of California, with their small number of varieties, believe such a service is necessary to successfully develop their industry, it seems to me all the more reason why you, with your greater number of varieties, should have a similar service.

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*May 15, 1920. It is estimated that during the present year, 1920, approximately a million record buds will be handled through this organization.

This service should be open to every person interested in citrus growing in the whole state. I have talked with the officials of the Florida Citrus Exchange, with Professor Newell and his associates of the Plant Board, and with Professor Rolfs, and all are agreed that the logical place for such a public service in Florida is in the Florida State Experiment Station. If the growers demand it the work can be started.

In the neighboring state of Alabama there is a small citrus industry. In Baldwin and Mobile Counties the Satsuma orange is raised. Dr. Tanaka, of the office of Crop Physiology and Breeding Investigations, United States Department of Agriculture, has found in his studies in Japan that the Satsuma orange in reality is not a true variety but a group, and that within this group there are a number of important varieties. Surveys conducted by Dr. Tanaka and myself in Alabama have shown that three of the Japanese varieties have already been introduced and are now shown in the Alabama orchards.

In cooperation with the Alabama Horticultural Society, and the State Experiment Station at Auburn, surveys have been made of practically every bearing grove in the two counties, and the variety of Satsuma borne by the different trees has been noted. In addition, we have determined which variety was carried by the leading nurseries in the South which have specialized in this particular fruit. For instance, one of the leading nurseries handle only the Owari, which in Alabama matures the latter part of October or the first of November. This fruit is flat, thin-skinned, depressed at both the blossom and stem end, and has characteristic leaves and habit of growth. Other nurseries carried the Ikeda variety, the fruits of which are spherical, not depressed at either end, thicker skinned, and mature about a month later than the Owari. All the nurverymen now operating in Alabama are only securing budwood from orchards which the Alabama Horticultural Board will certify are either Owari or Ikeda. The other variety, Zairai, does not seem worthy of propagation. In addition to this some of the growers are now securing individual-tree records so that in a few years the nurserymen will be able to get their budwood from the best producing trees within these varieties.

I mention this particular instance in a neighboring state which shows how the question of selection, if properly handled, can be of great value to an industry.

I have every confidence in the future of the Florida citrus industry. I do not believe, however, that you are going to make the development which you should make unless you begin at once to reject many of your worthless varieties, and to develop only the best producing strains within your standard varieties. I see no reason why the Florida citrus growers can not do just as much as the California citrus people, as the avocado growers in that state, or the Satsuma growers of Alabama. The office of Horticultural and Pomological Investigations of the United States Department of Agriculture stands ready at any time to assist you in this work.

FUMIGATION AT FLORIDA PORTS

J. H. Montgomery

The farmers and fruit growers of Florida are probably not aware of the fact that they are being afforded exceptional protection against invasion by plant pests from foreign countries at the entry ports of Key West and Port Tampa. Complete fumigating plants have been built at both of the ports referred to and all commercial offerings of fruit and vegetables from foreign ports are subjected to treatment with hydrocyanic-acid gas. The Key West plant has a capacity of 700 crates and the Port Tampa plant a capacity of about 500 crates. These plants are complete in every detail, even to having exhaust fans to quickly clear the rooms of gas after fumigation.

The Plant Board inspectors, who are also collaborators of the Federal Horticultural Board, formerly had to inspect all offerings of horticultural products. This was found to be an arduous, as well as an unsatisfactory procedure. Exhaustive investigations were conducted by both state and federal experts as to the effects of fumigation of fruits and vegetables, with the result that it was decided to put fumigation of commercial shipments into practice.

The fumigating plants are operating to the entire satisfaction of all parties concerned. The materials subjected to treatment are not injured, the work of the inspectors is facilitated, and delivery of imports is greatly expedited. The results of the work at Key West and Port Tampa have been proven so satisfactory that it is the hope of State Plant Board officials that fumigating plants of adequate size and equipment to meet the necessities will, at no distant date, be in operation at each of the ports of entry in Florida.

THE QUARTERLY BULLETIN

State Plant Board of Florida

DEVOTED TO APPLIED ENTOMOLOGY AND PLANT PATHOLOGY IN GENERAL, WITH SPECIAL REFERENCE TO THE PREVENTION, CONTROL AND ERADICATION OF INJURIOUS INSECTS AND PLANT DISEASES IN FLORIDA.

Sent free to all citizens of Florida. Offered in exchange for publications of the Federal and foreign governments and experiment stations, entomological and mycological journals, agricultural and horticultural papers and other publications of a similar nature.

WILMON NEWELL, *Plant Commissioner*............*Editor*

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DEPARTMENT OF CITRUS CANKER ERADICATION

REPORT ON ERADICATION WORK IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, FOR QUARTER ENDING JUNE 30, 1920

Citrus grove trees inspected	1,438,051
Citrus nursery trees inspected	16,419,006
Inspectors employed	102
New properties showing infection	0
Total properties showing active infection	0
Grove trees found infected	0
Nursery trees found infected	0
Counties in which active infections were found	0

GENERAL SUMMARY

Florida counties in which canker has been found	22
Grove trees found infected since May, 1914	13,727
Nursery trees found infected since May, 1914	342,254
Number properties infected to June 30, 1920	481
Properties declared no longer "danger centers"	479
Properties still classed as "infected" June 30, 1920	2

The following table shows the number of citrus grove trees found infected with canker during each month from the beginning of the eradication work to June 30, 1920:

Number of Grove Trees Found Infected With Canker, Per Month, Since the Work Began in May of 1914

1914		1915		1916		1917		1918		1919		1920	
		Jan.	306	Jan.	86	Jan.	14	Jan.	0	Jan.	0	Jan.	0
		Feb.	165	Feb.	21	Feb.	4	Feb.	1	Feb.	0	Feb.	0
		Mar.	444	Mar.	49	Mar.	9	Mar.	1	Mar.	1	Mar.	0
		Apr.	408	Apr.	49	Apr.	169	Apr.	2	Apr.	1	Apr.	0
May	108	May	1042	May	338	May	52	May	1	May	1	May	0
June	160	June	772	June	450	June	45	June	10	June	0	June	0
July	275	July	651	July	349	July	39	July	0	July	0		
Aug.	1313	Aug.	1345	Aug.	219	Aug.	30	Aug.	0	Aug.	1		
Sept.	767	Sept.	618	Sept.	124	Sept.	6	Sept.	0	Sept.	0		
Oct.	565	Oct.	214	Oct.	451	Oct.	2	Oct.	0	Oct.	0		
Nov.	773	Nov.	494	Nov.	131	Nov.	1	Nov.	0	Nov.	0		
Dec.	366	Dec.	256	Dec.	27	Dec.	1	Dec.	0	Dec.	0		
	4327		6715		2294		372		15		4		

QUARANTINE DEPARTMENT

Report on Inspections and Interceptions, All Ports and Stations, for the Quarter Ending June 30, 1920

During the quarter ending June 30, 1920, inspectors of the State Plant Board stationed at the several ports of entry in Florida intercepted one hundred and eight shipments of infested or infected horticultural material from seven foreign countries. This material was of course safely disposed of. A number of the shipments were carrying pests which are not now known to be present in the United States. Other shipments were found to be infested or infected with pests which have neither become firmly established nor widely spread in this country. A statistical statement of the work of the Port Quarantine Service follows:

Ships Inspected:

From foreign ports	716	
From U. S. Ports other than Florida	333	
From Florida ports	206	
Total		1,255

Number of Parcels Inspected:

Arriving by water:

Passed	88,767	
Treated and passed	16,035	
Returned to shipper	576	
Contraband destroyed	368	
Total		105,746

Arriving by land, express, freight, wagon, etc.:			
Passed	4,265		
Treated and passed	8		
Returned to shipper	2,917		
Contraband destroyed	25		
Total		7,215	
Arriving by mail:			
Passed	596		
Treated and passed	8		
Returned to shipper	42		
Contraband destroyed	9		
Total		655	
GRAND TOTAL OF PARCELS INSPECTED			113,616
Number of parcels on hand pending determination as to final disposition	67		
TOTAL PARCELS PASSED	93,628		
TOTAL PARCELS TREATED AND PASSED	16,051		
TOTAL PARCELS RETURNED TO SHIPPER	3,535		
CONTRABAND DESTROYED	402		
GRAND TOTAL			113,616

BEE DISEASE ERADICATION

REPORT ON INSPECTION AND ERADICATION WORK FOR THE QUARTER ENDING JUNE 30, 1920

Number of apiaries inspected	171
Number of apiaries infected with American foul brood	14
Number of colonies inspected	6,056
Number of colonies infected with American foul brood	25
Number of colonies destroyed, American foul brood	25
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	2
Number of colonies treated, European foul brood	2
Number of colonies infected with sacbrood	630

GENERAL SUMMARY

Number of apiaries inspected since July 1, 1919	366
Number of apiaries infected with American foul brood	37
Number of colonies inspected since July 1, 1919	15,007
Number of colonies infected with American foul brood	103
Number of colonies destroyed, American foul brood	103
Number of colonies treated, American foul brood	0
Number of colonies infected with European foul brood	5
Number of colonies treated, European foul brood	5
Number of colonies infected with sacbrood	638

It is reported, on good authority, that the sweet potato weevil is doing severe damage in Jamaica, the farmers having found in many instances that the sweet potato crop is so badly injured by this pest that the crop is not worth the work of harvesting. An excellent argument for prosecuting vigorously the work of eradicating this insect from Florida.

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